ANTECEDENTS OF INNOVATION IN ORGANISATIONS:

A GENDER PERSPECTIVE

by

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Declaration

I certify that the thesis submitted by me for the degree Philosophiae Doctor (in Leadership in Performance and Change) at the University of Johannesburg is my independent work and has not been submitted by me for a degree at another university.

Renier Steyn

Abstract

Background: A plethora of evidence suggests that innovation is central to organisational survival. Whilst most research points to gender diversity being useful in fostering innovation, the difference in the way men and women perceive the workplace, and the impact of these perceptions on their innovative work behaviour, are less pronounced. Aim: This research aims to assess the meaning men and women attach to organisational variables and the impact thereof on innovation. In identifying the gender-specific antecedents to innovative work behaviour, business leaders could adjust the workplace in order to optimise innovation in the workplace. Setting: Employed men and women, across several South African organisations, capable of reporting on their perception of the workplace, were included in the study. Method: A cross-sectional survey design was used to collect data on innovative work behaviour and acknowledged antecedents thereto. After eliminating instruments which were not measurement-invariant, the relationships between the variables were assessed. Results: Men perceived more support to innovate, and were marginally more innovative than women. When using instruments which were measurement-invariant, no practical significant differences in the relationships between innovation and its antecedents were found. Conclusion: While gender diversity may influence innovation in teams, gender matters little at an individual level. Men and women therefore react similarly to organisational forces. Managerial implications: Men and women react in a similar way to the variables included in the study, and the relationships between these variables are comparable across gender. Gender differentiation in arranging the work environment is therefore unwarranted. Contribution: This research presents empirical data enlightening a current socio-political matter, dealing with gender at an individual rather than at a collective level, applying state of the art methods, and concluding that at an individual level, men and women react to the workplace in no dissimilar manner.

Key words: Gender, innovation, innovative work behaviour, workplace, South Africa, measurement invariance.

Preface

This thesis is a thesis by publication, a format that supports the development of journal articles and similar publications as a recognised means of reporting research, as well as obtaining a doctoral degree. The thesis comprises five articles, with two published in 2018, a further two accepted for publication in 2019, and one currently under review.

Steyn, R., & de Bruin, G. (2018a). Investigating the validity of the Human Resource Practices Scale in South Africa: Measurement invariance across gender. *SA Journal of Human Resource Management, 16*, 10 pages. https://doi.org/10.4102/sajhrm.v16i0.1038

Steyn, R. & de Bruin, G. P. (2018b). The structural validity and measurement invariance across gender of the Brief Corporate Entrepreneurship Assessment Instrument. *South African Journal of Economic and Management Sciences 21*(1), a1965. https://doi.org/10.4102/sajems.v21i1.1965

Steyn, R., & de Bruin, G. P. (2019). The structural validity of the Innovative Work Behaviour Questionnaire: Comparing competing factorial models. *The Southern African Journal of Entrepreneurship and Small Business Management, 11*(1), a291. https://doi.org/10.4102/sajesbm.v11i1.291

Steyn, R., & de Bruin, G. P. (2020). Gender-based differences in the manner individual and organisational constructs are measured: A test of measurement invariance. *SA Journal of Industrial Psychology, 46*(0), a1699. https://doi.org/10.4102/sajip.v46i0.1699

Steyn, R., & de Bruin, G. P. (2020). Gender differences in the relationship between innovation and its antecedent. *South African Journal of Business Management, 51*(1), a1675. https://doi.org/10.4102/sajbm.v51i1.1675

The layout and reference styles of the articles differ in accordance with the publication guidelines of the journals they were submitted to. The articles are presented in separate chapters, bordered by an introductory and a concluding chapter.

Dedication

This thesis is dedicated to my darling wife, Lydia von Wielligh-Steyn, who supported me throughout the process, not only as a sounding board, but also by assisting with the editing of the document. I love you very much.

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I am grateful to the University of South Africa, for funding the tuition fees for this study. Furthermore, I am appreciative of the guidance provided to me by my supervisor, Professor Deon de Bruin. I would also like to thank the MBL students who assisted with the collection of the data for the study. Last but not least, I am also indebted to Conrad Baudin, for his professional text and language editing.

CHAPTER 1: ORIENTATION

This research, in general, is concerned with the role gender plays in organisations when innovative work behaviour (IWB) is required. More specifically, this research looks at the precursors to IWB across gender lines. Aligned with this topic, the title of the study is "Antecedents of innovation in organisations: A gender perspective". The aim of the study was to create credible information to manage or lead organisations, by being cognisant of the dynamics generated by employees identifying as men or women.

In this chapter the reader will be orientated to the study. Presented below is a general background to the study, a brief literature review to contextualise the study, a problem statement, as well as the aims and objectives of the study. The chapter commences with an explanation on why this study was conducted and how it was delineated. The theoretical framework within which the study was anchored is also captured here, as well as a more detailed section describing the research methods followed. The chapter is concluded by laying out how the rest of the thesis unfolds.

1.1 Background

The study focuses on possible differences in the way men and women attach meaning to the workplace environment and how these perceptions influence their levels of innovation. Three assumptions are embedded in this statement, namely that gender influences the way employees perceive and react to the workplace, that what we experience has a distinct influence on our behaviour (for instance on innovation) and that innovation is important to organisations.

The first assumption is contested by many. Philosophers such as Aristotle, Kant, Hegel, Rousseau, and many others, believe that the nature of women and men is fundamentally different (Honderich, 1995). Broadly speaking they state that women are emotional and that men are rational beings. They also consider women to be intuitive as opposed to men who are supposedly more analytical. Kvidal and Ljunggren (2014) found that a large body of literature exists in which gender articulations are in line with hegemonic conceptualisations

of gender, but also that attempts are made to challenge the predominant understanding of gender.

Gender is viewed as a social construction and there is a growing body of work that speaks of "doing gender" (Nentwich & Kelan, 2013; West & Zimmerman, 1987). As such, gender is often understood as culturally-learned beliefs about what it means to be male or female (Best, 2010; Bian, Leslie, & Cimpian, 2017). Gender is still considered to be the key social differentiator between individuals (Stangor, Lynch, Duan, & Glass, 1992), and the feminist movement is grounded in society's recognition of gender and the perception of gender differences (Calás & Smircich, 2009; Higgs & Smith, 2006). According to the latter, feminists advocate for an in-depth analysis of gender and how gender and society influence each other.

The second assumption may be more contested than the first, but within the context of Industrial and Organisational Psychology it is generally assumed that employee attitudes are a function of the environment to which workers are exposed and that these attitudes influence behaviour in the workplace. Articles with titles like "The impact of the working environment on organisational performance: The mediating role of employee's job satisfaction" (Ashraf, Bashir, Bilal, Ijaz, & Usman, 2013) and "The relationship between HRM practices and organisational performance in the public sector: Focusing on mediating roles of work attitudes" (Ko & Smith-Walter, 2013) typify this kind of deterministic and positivistic reasoning which is common in the field of research in Industrial and Organisational Psychology (see also Atitumpong & Badir, 2018; Bos-Nehles & Veenendaal, 2019; Ogbeibu, Senadjki, & Gaskin, 2018; Rehman, Ahmad, Allen, Raziq, & Riaz, 2019).

The assumption regarding the importance of innovation seems less contested. Innovation is generally seen as important and as an essential component for competitiveness and survival, embedded in organisational structures, processes, products, and services within the organisation (Gunday, Ulusoy, Kilic, & Alpkan, 2011). Innovation is considered by many scholars as one of the most important determinants of firm performance (Adegoke, Walumbwa, & Myers, 2012; Durán-Vázquez, Lorenzo-Valdés, & Moreno-Quezada, 2012; Grant, 2012). The importance of innovation is also reflected in its definitions. Overstreet, Hanna, Byrd, Cegielski, and Hazen (2013) describe innovation as the propensity of an organisation to deviate from conventional industry practices by creating or adopting new

products, processes or systems. Similarly, Golla and Johnson (2013) use the term in relation to products and define it as the introduction to the market of new goods or services with distinct characteristics.

For the purposes of this research it is therefore assumed that gender influences the way employees perceive and react to the work environment, that employee experiences have an influence on their behaviour, and that innovation is important to the survival of organisations.

1.2 Literature review / Contextualisation

Gender is generally assumed to be culturally-learned beliefs about what it means to be male or female (Best, 2010; Richerson & Boyd, 2017). Culture is seen as a significant element in gender matters and is considered to affect people's "modes of being" in the world (Jakobsen, 2016; Kitayama, Duffy, & Uchida, 2007). This notion of culture influencing gender descriptions is to a certain extent in line with Richardson's (2015) views that modern cultures allow for greater variation in gender identification, with contemporary definitions going far beyond simply labelling individuals as men and women[1]. Endemic to gender identification and differentiation is gender discrimination, and in addition to the man-woman discrimination traditionally experienced (Molina, Little, & Rosal, 2016), it should be acknowledged that discrimination against lesbian, gay, bisexual, and transgender individuals (LGBT) is rife and substantial (Badgett, Lau, Sears, & Ho, 2007; Baumle, Badgett, & Boutcher, 2019; Gorsuch, 2019; Grant, Mottet, Tanis, Harrison, Herman, & Keisling, 2011). The magnitude of this reported discrimination certainly necessitates further debate and research in the domain.

Some cross-cultural psychologists deem it naïve to think that culture alone determines behaviour (Berry, Poortinga, Breugelmans, Chasiotis, & Sam, 2011). It is argued that biology, particularly when it concerns genes and hormones, plays a significant role in gender behavioural differences (Lamb, Pleck, Charnov, & Levine, 2017). Myers (2008) argues that, as genes predispose muscle development in men to hunting, they also predispose women to breastfeeding, making it a viable assumption that genes also influence less salient gender-

[1] Many more gender identifications exist, which necessitated the use of acronyms such as LGBTQIAGNC, which stand for "lesbian, gay, bisexual, trans, queer, intersex, asexual and gender-non-conforming." Though these permutations are acknowledged, this research will focus on self-identifying men and women, a divide which primarily represents the biological sex and more traditional gender role identification prevalent in South African society.

related behavioural attributes. Regarding hormones, Myers (2008) argues that testosterone levels affect the intensity of aggression particularly in young males, but as the testosterone differences between males and females level out in middle age, “women become more assertive and self-confident and men more empathetic and less dominating” (Myers, 2008, p. 177). Some scholars in the feminist movement are opposed to such reasoning, and these scholars “question from the outset the apparent naturalness and inevitability in the status quo” (Calás & Smircich, 2009, p. 247).

Given the aforementioned, feminists may doubt the essence of the seminal work of Munroe and Munroe (1975) which suggested that behavioural differences between males and females are modal. They may also question the findings of observational studies indicating that women who generally invest more in relationships (see Rossi & Rossi, 1990; Taylor, 2002; Tamres, Janicki, & Helgenson, 2002), are less inclined to express dominant behaviour (see Barry, Child, & Bacon, 1959; Pratto, 1996; Schwartz & Rubel, 2005), are less aggressive (see Archer, 2002, 2004; Björkqvis & Österman, 2018; Daly & Watson, 1988), and tend to be less sexually assertive than men (see Segall, Dasen, Berry, & Poortinga, 1990; Schmitt, 2005). Feminists may furthermore pose questions about who the researchers were, what their power relations entailed, as well as on their interests (Calás & Smircich, 2009).

Considering gender differences observable in the choices women exercise in the workplace, such outcomes might be judged by some feminists as serving a capitalist or managerial agenda, as these perspectives tend to be contrary to female interests (Calás & Smircich, 2009). Some research enforces stereotypes, suggesting that women usually gravitate towards jobs that reduce inequality, whilst men prefer jobs that accentuate it (Del Giudice, Gangestad, & Kaplan, 2015; Pratto, Stallworth, & Sidanius, 1997). It is similarly reported that women prefer positions that involve personal relations and helping others, whilst men are attracted to jobs that focus on challenge and power (Hogue, Fox-Cardamone, & Knapp, 2019; Konrad, Ritchie, Lieb, & Corrigall, 2000). These research findings might possibly be frowned upon. Similarly, research which points to differences in work scheduling, particularly regarding family responsibility (Grönlund & Öun, 2018; Shellenbarger, 1991), where women usually bear the bulk of domestic tasks (Cascio, 2010), and where female individuals seemingly tend to prefer part-time work and flexible schedules to enable them to attend to family matters (Robbins & Judge, 2011), would be seen from a societal, rather than

a purely organisational perspective. Boushey (2008), a feminist economist, states that such "choices" may have more to do with society's inability to accommodate the realities of the workforce, than with the mothers' true preferences.

It may be expected that the bulk of research dealing with gender differences, including research on behaviour in the workplace, might be critiqued by feminists, because traditionally such research is conducted and reviewed from a "male-centric" and stereotypical perspective (Haynes, 2008; Levy, 1984; Logan & Huntley, 2001). The following statements about differences between the sexes are typical of such perceived archaic research:

- Women tend to express emotion more often in the workplace (LaFrance & Banaji, 1992) – excluding anger (Grossman & Wood, 1993), maybe as anger is negatively perceived when specifically expressed by women (Salerno, Peter-Hagene, & Jay, 2019).
- Females are more adept than males with regard to reading non-verbal cues (James, 1989), with women displaying higher levels of emotional intelligence (Fida, Ghaffar, Zaman, & Satti, 2018).
- Bennie and Huang (2010, p. 23) report that "there are significant differences between males and females with regard to how their stress and emotions are managed and expressed" in the workplace. Tripathi and Ghosh (2018) report similar results.
- Women tend to contemplate more than men do (Nolen-Hoeksema & Jackson, 2001) and are likely to over-think problems (Elias, 2003).
- They are less prone to risk-taking (Barber & Odean, 2002; Byrnes, Miller & Schafer, 1999), unless managed by other women, when they take on significantly more idiosyncratic risks (Dezso, Rawley, & Ross, 2018).
- Female employees are less likely to pose a health or safety risk in the workplace (Mühlau, 2011; Stergiou-Kita, Mansfield, Bezo, Colantonio, Garritano, Lafrance, ... & Theberge, 2015), although some research in this regard reports contrary findings (Curtis, Meischke, Stover, Simcox, & Seixas, 2018).
- Female employees also tend to rate communal factors in the workplace as more important than men (Frame, Roberto, Schwab, & Harris, 2010). They also rate other women in the workplace as more communal than men (Hentschel, Heilman, & Peus, 2019).

Despite the aforementioned examples, there is not an abundance of management[2] articles or textbooks that discuss gender differences. The lack of research and discussions around gender differences constitutes one of the reasons for conducting this research. This void is discussed in more detail under heading 1.5 (Importance of the study).

What could be concluded from the aforementioned text is that the conceptualisation and influence of gender in the workplace are controversial and under-researched elements.

Apart from gender, innovation is the other important variable in this research, and a brief introduction may be relevant here. Though some confusion exists on the exact meaning of innovation in the workplace (Hind & Steyn, 2015), definitions on the concept abound. García-Morales et al. (2008) describe innovation as new ideas, methods or devices, or acts of creating new products, services or processes. Similarly, Golla and Johnson (2013) use the term in relation to products and define it as the introduction to the market of new goods or services with distinct characteristics. Overstreet et al. (2013) describe innovation as the propensity of an organisation to deviate from conventional industry practices by creating or adopting new products, processes or systems. In this research innovation will be described at an individual level, following Kleysen and Street's (2001) conceptualisation of Innovative Work Behaviour (IWB), which they borrow from West and Farr (1989), referring to "all individual actions directed at the generation, introduction and/or application of beneficial novelty at any organisational level" (p. 285). Kleysen and Street (2001) theorize that IWB consists of five distinct elements, namely opportunity exploration, generativity, information investigation, championing and application[3].

Innovation could be seen as important as it constitutes an essential component for competitiveness and survival, embedded in organisational structures, processes, products and services within the organisation (Gunday et al., 2011). As a result, innovation is considered by many scholars as one of the most important determinants of company performance (Adegoke et al., 2012; Durán-Vázquez, Lorenzo-Valdés et al., 2012; Grant, 2012).

[2] The terms "management" and "leadership" are used interchangeably in the conceptualisation part of this thesis (Chapter 1), as the effects of both management and leadership (see Riggio, 2017) on innovation were assessed. Later on in the thesis, when dealing with the specific hypotheses, a clear distinction is drawn between the concepts. The practice of discussing both concepts simultaneously is compatible with general management and leadership research (Podsakoff & Podsakoff, 2019), gender-related management and leadership research (Kuhlmann, Ovseiko, Kurmeyer, Gutiérrez-Lobos, Steinböck, von Knorring ... & Brommels, 2017), as well as similar research on management and leadership conducted in South Africa (Mamabolo, 2018).

[3] The different elements of IWB will be discussed in detail in Article 3 (Chapter 4).

For this reason, managers have an obligation to manage the work environment in a manner that will facilitate innovation. It is important to identify the antecedents to innovation, to differentiate between important and less important drivers of innovation and to manage these drivers in an effective manner (Bigliardi 2013; Ndregjoni & Elmazi 2012). The facilitation of innovation is therefore an essential management function of managers (Madmoli, 2016; Michaelis, Stegmaier, & Sonntag, 2010; Yen, 2013), as it is interconnected with organisational performance.

Innovation, at an individual level, and across gender, is often addressed in academic literature referring to entrepreneurship. The interchangeable use of the terms is understandable, particularly when considering the various elements of IWB and the overlap between these elements and entrepreneurship. As literature on gender and IWB is scarce, the related literature on gender differences in entrepreneurship is presented in Text Box 1. [Two text boxes are presented in this thesis, dealing with entrepreneurship and gender diversity. Entrepreneurship is related to the main theme of the research, namely innovative work behaviour, but as a distinct concept. However, because of the scarcity of literature on gender and innovative work behaviour, this is presented to complement the presented literature. While literature on gender diversity is abundant, gender diversity deals with groups and this literature is very different to that of gender as an independent variable. Literature on gender diversity is presented to acknowledge the importance of this field of research, but also to contrast findings on gender diversity with data on gender, when gender is presented as an autonomous variable. Text boxes are used to introduce these associated concepts, but still allow the text to flow naturally.]

Text Box 1:

Differences between men and women with regard to entrepreneurship

Academic research has endeavoured to understand women's behaviour in entrepreneurial activity, identifying the differences compared to men. These include individual characteristics and motivations, leadership style, strategic choices, obstacles experienced and reasons for results/outcomes (Pablo-Martí, García-Tabuenca, & Crespo-Espert, 2014). Caňizares and García (2010) studied gender differences among potential entrepreneurs and

their psycho-sociological traits, as well as the incentives and principal obstacles women encounter when initiating a business activity. Considering the innovators, differences were found, for example with regard to the amount of time devoted by entrepreneurial women to household chores, the higher proportion of women in the staff they employ, and their commitment to product and service innovation (Pablo-Martí et al., 2014). Some results suggest that females are less prone to initiate entrepreneurial activity and that fear of failure constitutes a major obstacle to setting up a company. Furthermore, gender attributes were correlated to a higher probability of embarking on a venture of the same type, even after failure at a previous attempt (Caňizares & García, 2010). Others also show the existence of gender differences in entrepreneurial intentions (Sánchez-Escobedo, Díaz-Casero, Díaz-Aunión, & Hernández-Mogollón, 2014). Male and female reasons for success and survival are found to be substantially the same, but personal characteristics and motivations were found to be different (Pablo-Martí et al., 2014). Male respondents indicated a higher overall satisfaction with venture performance than females (Sonfield, Lussier, Corman, & McKinney, 2001). However, results of prior research pertaining to gender and entrepreneurial success are mixed (Sonfield et al., 2001). It is interesting to note that the explanatory power of models on the link between gender and entrepreneurial intensions increases as the degree of economic development expands, and that the exposed models are also more conclusive/explanatory for men than women (Sánchez-Escobedo, Díaz-Casero, Díaz-Aunión, & Hernández-Mogollón, 2014). Furthermore, research into the gender perspective of entrepreneurial intent is key to gaining deeper insight into the economic and social phenomenon of female entrepreneurship (Caňizares & García, 2010). How assessments are done, and having a cognisance of "gendered" measurement instruments, also play a role in how the entrepreneur is portrayed (Sánchez-Escobedo, Díaz-Casero, Hernández-Mogollón, & Postigo-Jiménez, 2011). The matter of assessment and gender, within the innovation context, is a key feature of this research, and is discussed in more detail under heading 1.5 (Importance of the study).

Research findings on gender and innovation are mixed. Some researchers point to no gender effects. In their research, Sonfield et al. (2001) found no significant gender differences in venture innovation/risk situation or in strategies chosen by business owners. Kvidal and

Ljunggren (2014) boldly report that gender is a non-issue to innovation. Other researchers question past research which reported differences between gendered outcomes and found that resource and context characteristics fully mediate the entrepreneur-gender-firm performance relationship (Lee & Marvel, 2014). These types of findings are not surprising, as research in the area of gender and innovation is often conducted in different disciplines, applying a variety of methodological approaches (Alsos, Ljunggren, & Hytti, 2013). In addition, research on gender and innovation can be complex, as gender could be perceived as a variable, construction, or a process, whereas innovation is seen as a result, process and discourse (Alsos et al., 2013). Gender may also be interpreted as a variable of a socio-demographic nature, or as a dependent variable (Sánchez-Escobedo et al., 2014).

Whilst some authors, such as those above, suggest that research on innovation should consider the gender of the actors involved as independent individuals (also see Nählinder, Tillmar, & Wigren, 2015), other researchers stress the importance of the environment (Hornsby, Kuratko, & Zahra, 2002). One element in the environment, which may influence innovation, is the composition of the workforce, and the bulk of the research related to gender and innovation relates to gender diversity. Although gender diversity is not central to this thesis, this document would be incomplete should this element be excluded. Presented in Text Box 2 is some literature with regard to gender diversity and innovation.

Text Box 2:

Gender diversity and innovation

Gender diversity could be an important factor in innovation and therefore in the success of organisations. Gender diversity within research and development teams, for example, generates certain dynamics that foster novel solutions leading to radical innovation (Díaz-García, González-Moreno, & Sáez-Martínez, 2013). Sastre (2014) investigated the effect of gender diversity in research and development teams on different innovation outputs: products, services, process, and organisational innovations. The researcher argued that some innovations are best positioned to capitalise on the benefits of gender diversity, because of the greater relevance of market insight and personal interactions. Considering the outputs, gender diversity affects the likelihood of different types of innovation

outcomes differentially, as the tasks required for different types may be specific to gender diversity (Fernández, 2015; Sastre, 2014). For example, it was found that gender diversity produces its most significant effect on product innovation, followed by service and organisational innovation, and less in the case of process innovation (Sastre, 2014). Fernández (2015) similarly reports that gender diversity produces a greater impact on product innovation than on process innovation. Along these lines, and focussing on gender equality, Alsos et al. (2013) suggest that innovation scholars and policy-makers should not primarily target radical and product innovations, but should be equally interested in incremental and process innovations. On a more evolutionary note, Eriksson (2014) found that a gender perspective contributed to innovations by triggering innovation and supporting the innovative processes, ensuring that the innovations did not stop at initial creative solutions. Some researchers point to very specific effects. Allowing for systematic correlations among different innovation outcomes, the results indicate that the relationship between gender diversity and all the different innovation outputs (products, services, process and organisational innovations) is shaped like an inverted-U (Sastre, 2014). Fernández (2015) claims that only the relationship between gender diversity, as well as product and process innovation, has that shape. The same author (Fernández, 2015) suggests that gender diversity has a positive linear association with service innovation. It could be concluded that conducting research on gender and innovation is important, as "literature on diversity in organisations is limited and even fewer studies investigate its impact on innovation" (Díaz-García et al., 2013, p. 149).

From a feminist perspective, the core role of organisations, as societal institutions "centrally involved in the production and maintenance of social relations of inequality and subordination", is very important (Calás & Smircich, 2009, p. 247). It is suggested that society has a "vested interest in gender norms" (Byrne, 2015, no page), and, in accordance with third-wave feminism, men are viewed as "intrinsically malicious in their dealings with women" (Higgs & Smith, 2006, p. 40). Innovation, which was introduced earlier, and innovation processes, are intertwined in organisational structures and the functioning thereof (Kovalainen & Poutanen, 2013). Though the open innovation paradigm leans on aspects such as openness, collaboration, creativity and intuition – much in line with feminine discursive

connotations – masculine norms normally govern the company setting where these alternative modes of organising tend to be either marginalised, appropriated or transformed in ways that ensure that they are compatible with discourses and practices of masculinity (Wikhamn & Knights, 2013). As stated earlier, Kvidal and Ljunggren (2014) found that gender articulations about innovation are in line with hegemonic conceptualisations of gender, and that at the moment attempts are made to challenge the male dominant understanding of innovation.

Some argue that context (both social and geographical) (Blake & Hanson, 2005), as well as institutional environment, matter in the case of innovative activity by women (Carrasco, 2014). Beck (2009), for example, argues that the negotiation of socially and culturally adequate gendered behaviour affects innovation. Also, understanding women's innovation activity needs to be embedded in grasping the normative frames and structural factors at play, and it is in turn linked to the study of power and innovation (Alsos et al., 2013). This is complemented by thinking which suggests that innovation processes are influenced by the masculine discourses of rational control and competition, discourses which are also reinforced during these processes (Harrer & Lehner, 2018; Reddy, Sharma, & Jha, 2019; Wikhamn & Knights, 2013). Organisations are gendered through, among other things, tokenism and the persistence of male dominance (Kovalainen, & Poutanen, 2013). Carrasco (2014) also suggests that we have to consider gender segregation in the job market and gender differences in education and training when studying innovation.

Masculinity enters the discourse of open innovation through prescribed classical management ideals in line with auditing and bureaucratisation. It is reproduced rather than challenged by open innovation, and is supported through a preoccupation with control and conquest which tends to silence alternative (feminine) discourses (Wikhamn & Knights, 2013). It is expectedly argued that previous studies on innovation have primarily focussed on male-dominated industries, and that the results have been biased and unable to capture innovations among women (Nählinder et al., 2015). Blake and Hanson (2005), for example, state that in many instances innovation, that occurs in economic sectors and by agents that are typically ignored or undervalued, is also ignored by current research and by policy. This phenomenon is linked to women displaying different profiles and outcome expectations – differentiating between those operating in the “open market” and those who mainly operate

in sectors traditionally considered as female (Pablo-Martí et al., 2014). Research on innovation should consider the gender label of the sector studied (Nählinder et al., 2015) and should question the connection between technology and innovation and purposefully seek innovation activity in low-tech and service sectors or firms (Alsos et al., 2013).

Blake and Hanson (2005) urge researchers to expand their concepts of innovation to be more gender-inclusive. Johansson and Lindberg (2011) argue for a more inclusive view on innovation related to gender, as policy and research both tend to disregard certain innovations that are pursued by some actors/players in particular areas. Programmes to promote entrepreneurial activity must take into account differences between men and women in terms of their perceptions and entrepreneurial culture (Caňizares & García, 2010). More dimensions should be considered in future innovation studies that aim to analyse gender neutrality (Nählinder et al., 2015).

Some researchers suggest that gender perspectives are very seldom employed in innovation studies and that quantitative studies in this regard are particularly rare. They also argue that there is an urgent need for such studies to broaden the concept in academic, political and public debates (Nählinder et al., 2015). Discovering gendered structures is important to further develop gender-equal societies (Alsos et al., 2013). Kvidal and Ljunggren (2014, p. 39) warn against rhetoric when arguing that, "when seeking to integrate gender perspectives in policy programmes, the rationale needs to be clear and understood at all programme levels".

1.3 Problem statement

Stereotypes regarding gender differences, gender diversity, and the relative importance of employing women versus men in the workplace, combined with the enforcement of gender-based employment equity in the workplace, necessitate social scientists and practitioners to find clarity on how men and women attach meaning to organisational variables, and whether these variables affect employee behaviour differentially. This problem could be operationalised by stating that gender-based bias may manifest in the way constructs are measured and how the constructs relate to each other – that measurement and structural invariance may exist. As stated before, present literature on this aspect is ambiguous. Clarity

is necessary as it will inform the fair evaluation of prospective or current employees (with reference to measurement invariance as well as the appropriate development of current employees[4] (with reference to structural invariance). The focus on gender is particularly relevant in South Africa, given the challenges of a society characterised by gender differentiation and gender-based discrimination, and a need for readdressing the ails of the past.

Innovation in the workplace, an important indicator of innovation amongst ordinary employees, is the primary focus of this research on gender bias. Organisations need to employ or develop as many employees as possible to get involved in innovation in facing the challenges which currently await them within the context of the fast pace of chance and the advances required to survive during the fourth industrial revolution. Knowledge about the antecedents to innovation is an important matter globally, but it may be particularly important in the South African context, where the state is the largest employer, and where innovation within state entities affects the economy of the entire country. Bringing about change in large bureaucratic state departments and state run enterprises may be more difficult than in the corporate environment, where the imperatives for innovation are driven by competition. Given the sorry state of many South African organisations, particularly state-owned entities, innovative work behaviour seems lacking.

Thus, given the emphasis on gender as an important political device, and a potential differentiator in attaining organisational success, research on gender-based invariance in the measurement of innovative work behaviour, and invariance in the relationship between that element and known predictors thereof, is necessary.

1.4 Aim and objectives

The aim of the study was to empirically compare the meaning that men and women attach to organisational variables and how these variables impact on their innovative behaviour in organisations. The research critically examined the notion that men and women experience the organisational context in different ways and that male and female individuals respond differently to organisational influences with regard to innovation. This aim is in line with the

[4] Development programmes specifically targeting women are not unusual in South Africa.

call that future innovation studies should aim to analyse gender neutrality (Nählinder et al., 2015).

As can be observed from the aforementioned aim, gender was treated as a distinct variable, as sex, focussing on the differences and similarities between men and women. Alsos et al. (2013, p. 243) refer to this approach as "empiricist feminism".

Four empirical research objectives were set for this study:

1. To empirically investigate the extent to which women and men attach the same meaning to a selection of antecedents to innovative behaviour. More specifically, to report on the psychometric equivalence of the Corporate Entrepreneurship Assessment Instrument (Hornsby et al., 2002), the Utrecht Work Engagement Scale-9 (Schaufeli & Bakker, 2003 Schaufeli, Bakker, & Salanova, 2006), the Multifactor Leadership Questionnaire (Avolio, Bass, & Jung, 1995, 1999), the Organizational Commitment Scale (Allen & Meyer, 1990), the Human Resource Practices Scale (Nyawose, 2009) and the Proactive Personality Scale (Bateman & Crant, 1993).

2. To empirically investigate the extent to which the Innovative Work Behaviour measurement instrument (Kleysen & Street, 2001), to be used in this study, displays acceptable psychometric properties, particularly the factorial structure as proposed by the developers of the instrument. This objective was pursued, as some ambiguity remains on its functionality[5], and the validity thereof needed to be established beforehand, as this was the measure of the dependent variable in the study.

3. To empirically investigate the extent to which the measure of innovation in the workplace displays psychometric equivalence regarding gender. More specifically, to report on the gender invariance of the Innovative Work Behaviour (Kleysen & Street, 2001) questionnaire.

[5] Other measures of innovative work behaviour also exist, and the factorial structure of these measures are also contested. See De Jong and Den Hartog (2010), Janssen (2000), and Scott and Bruce (1994).

4. To empirically investigate the effect of antecedents to innovation on innovative behaviour from a gender perspective. More specifically, to assess whether the relationship between antecedents of innovation and innovation is similar for both men and women (when using instruments which have psychometric equivalence regarding gender).

Given the achievement of the first three objectives, it was foreseen to test the gender equivalence across five models. In these models organisational variables, mostly embedded in organisational practices, were used as independent variables. The five independent variables are as follows: innovation climate (a composite score – one variable), leadership styles (transformational, transactional and laissez-faire leadership styles score – three variables), and human resource practices (also a composite score – one variable). X in Figure 1 (below) represents these independent variables. The dependent variable was innovative work behaviour, presented as IWB in Figure 1. Two employee attitudes, namely affective organisational commitment (AOC) and employee engagement (EE), were included as likely mediators in the models. Lastly, proactive personality (PP) was included as a personal attribute and a possible moderator of the employee engagement-innovative work behaviour link.

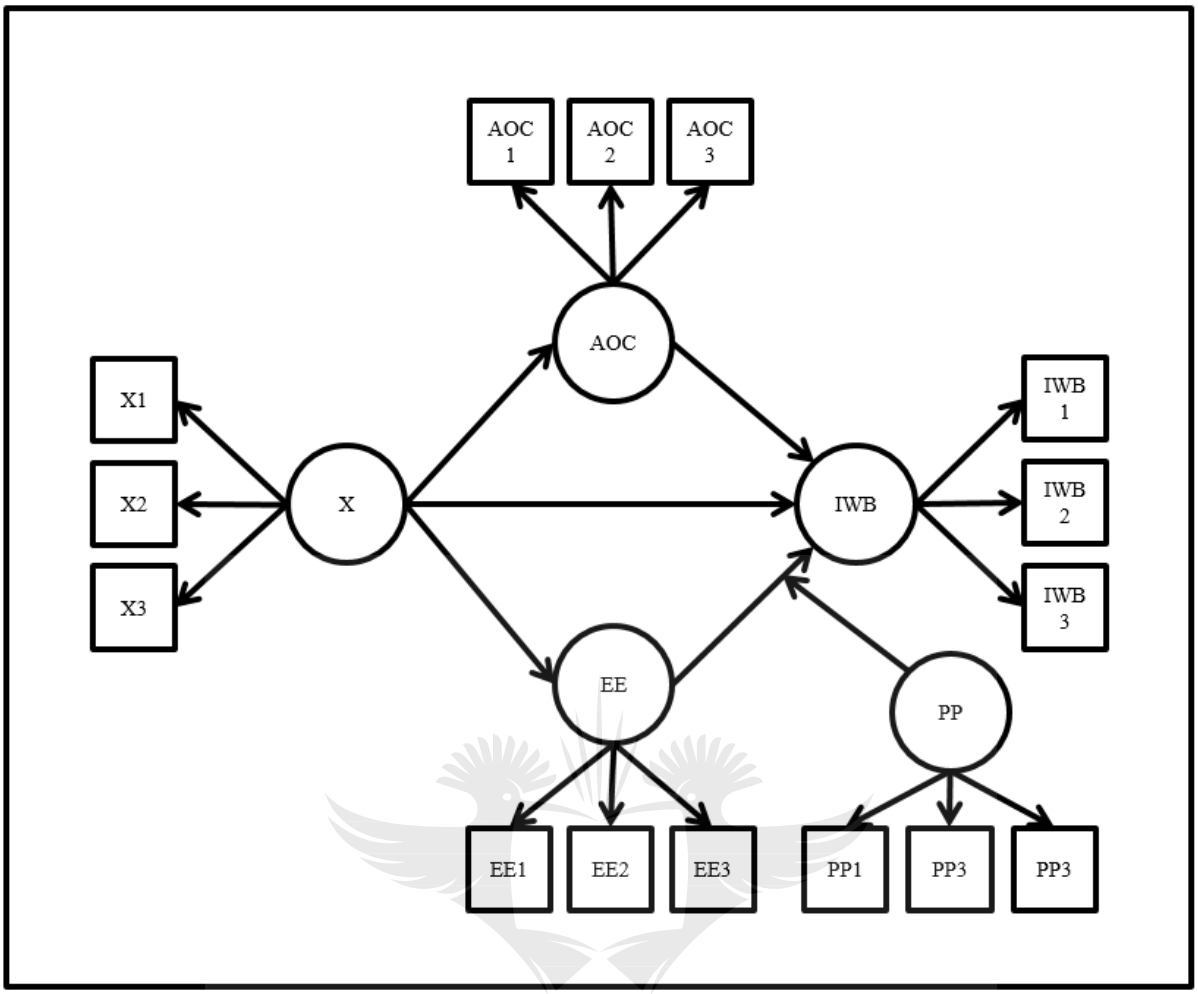

Figure 1. Antecedents to innovative work behaviour. X represents all the independent variables, namely the Human Resource Practices Scale (Nyawose, 2009), the Brief Corporate Entrepreneurship Assessment Instrument (Hornsby et al., 2002; Strydom (2013), and the Multifactor Leadership Questionnaire (Avolio et al., 1995, 1999); EE represents the Utrecht Work Engagement Scale-9 (Schaufeli & Bakker, 2003; Schaufeli et al., 2006); OC represents the Organizational Commitment Scale (Allen & Meyer, 1990); PP represents the Proactive Personality Scale (Bateman & Crant, 1993); and IWB represents the Innovative Work Behaviour questionnaire (Kleysen & Street, 2001).

In Figure 1 the latent variables are presented as if each of the latent variables were the product of three observed variables. Whilst this is not the case, presenting only three observed variables was done for presentation/aesthetic purposes.

The aim was to test this model across gender and to report on gender-based particularities in each model, so as to gain a better understanding of how men and women

perceive their workplaces (see X in Figure 1) and to determine how this relates to their attitudes (see AOC and EE in Figure 1), as well as workplace behaviour (see IWB in Figure 1).

Testing this model, and achieving the aforementioned objectives, resulted in the attainment of the research aim, and in two important ways. Firstly, it will determine for which instruments the meaning that men and women attach to organisational variables is similar. Secondly, after eliminating the instruments which were measurement non-invariant, it will be possible to assess if the antecedents of innovation impact differently on innovative behaviour in organisations if measured along gender lines. In this way, by using modern psychometric and statistical techniques, quantitative empirical evidence on the contentious issue of gender and innovation will be provided.

1.5 Importance of the study

This research is motivated by three reasons. Firstly, not enough is known about the role gender plays regarding innovation. Secondly, there are conflicting views about existing knowledge on the importance of gender as a workplace variable. Thirdly, the knowledge regarding gender differences is often obtained by means of outdated or inadequate methods.

The first reason for conducting the research may seem invalid and limited to an intuitive level. However, Chung and Brief (2008) are concerned that only five per cent of all articles published in management journals between 2000 and 2008 included race and gender as key words. In a search regarding publications which included these key words, several documents were found focussing on "gender diversity". However, very few were found using gender as a variable. The number of articles found in this search was very small, particularly "given the centrality of gender in human life" (Byrne, 2015, no page). Byrne (2015) urges us "to question why it does not occupy a (more) primary role" in research. This neglect of gender as a variable seems to coincide with the democratisation of the workplace (Cascio & Aguinis, 2014). It appears that contemporary authors of (human resource) textbooks (e.g. Cascio & Aguinis, 2014; Ivancevich, Konopaske, & Matteson, 2014; Robbins, & Judge, 2011) are not willing to write about gender differences, but rather focus on gender diversity. These authors seem reluctant to openly compare males with females, as was the case with earlier seminal publications, such as Cattell, Eber, and Tatsuoska (1988) and Guion (1965), who had no

problems reporting different norms for males and females. Conducting further research on gender (and innovation) may therefore be important, as "literature on diversity in organisations is limited and even fewer studies investigate its impact on innovation" (Díaz-García et al., 2013, p. 149). Nählinder et al. (2015) also call for further research on this matter and claim that gender perspectives are very seldom employed in innovation studies and that quantitative studies in this regard are particularly rare. The same authors also declare that there is an urgent need for such studies to broaden the concept in academic, political and public debates. From the aforementioned it is clear that there is a lack of, and a need for, empirical research on the role gender plays in innovation in the workplace.

Not engaging in such research and not researching the possibility of bias in workplace, will keep such bias hidden and sustain organisational patterns which may be discriminatory. Making bias, or the lack thereof, explicit will allow for the management of this phenomenon and the dynamics supporting the perseverance thereof.

The second reason for conducting the research is that there are conflicting views regarding what we know about the role of gender in innovation. Many researchers found a link between *gender diversity* and innovation in the workplace (PR Newswire US, 2013; Ruiz-Jiménez, Fuentes-Fuentes, & Ruiz-Arroyo, 2014). It was found, for example, that a positive relationship between gender diversity and financial performance exists in the case of companies operating in riskier environments (Francoeur, Labelle & Sinclair-Desgagné, 2008), that female directors have a significant impact on board inputs and governance, and that gender-diverse boards allocate more effort to monitoring management (Adams & Ferreira, 2009). This, however, does not occur in all situations (Parrotta, Pozzoli, & Pytlikova, 2014). It is suggested that the relationship between workplace diversity and organisational performance is "neither direct nor definitive" (McMahon, 2010, p. 44), with some cases showing that diverse teams (gender-balanced teams) "were no more innovative than all-male teams, nor were there any significant differences in the variety of alternative solutions between the two groups" (Fila & Purzer, 2014, p. 1405). "The impact of diverse composition in teams is neither straightforward nor direct, and evidence suggests that diversity can be either conducive or detrimental to team innovation" (Mitchell & Boyle, 2015, no page). Fernández (2015) and Sastre (2014) report that the relationship between gender diversity and

innovation outputs (products, services, process and organisational innovations) is normally shaped like an inverted-U, but did not find this in all cases.

Some researchers on *entrepreneurship* (focussing more on the individual than on the group) point to no gender effects. In their research, Sonfield, Lussier, Corman, and McKinney (2001) found no significant gender differences in venture innovation/risk situation or in strategies chosen by business owners. Kvidal and Ljunggren (2014) boldly report that gender is a non-issue in terms of innovation. Other researchers question past research which reported differences between gendered outcomes, and find that resource and context characteristics fully mediate the entrepreneur-gender-firm performance relationship (Lee & Marvel, 2014). Sonfield et al. (2001) state that results of prior research pertaining to gender and entrepreneurial success are mixed. The prevalence of mixed findings from diversity studies implies that the business case for the benefits of diversity is inconclusive (Tatli, 2011; Wentling, 2004).

The focus of research on "gender diversity" and "woman as entrepreneurs", as mentioned in the text boxes, and not considering men and women as individual actors in innovative work behaviour, as it occurs at all levels of the organisation, warrants further investigation. The role of the individual employee, engaged in innovative work behaviour, is ill-researched, particularly regarding whether gender differences actually occur where innovation is realised.

The third reason for conducting the research is that what we know about gender and innovation is often based on outdated or inadequate methods. The mixed findings should not be surprising, as the research is conducted in different disciplines, using a variety of methodological approaches (Alsos et al., 2013) and different methods to conduct assessments (Heitner, Kahn, & Sherman, 2013). Differences in findings could also be contributed to gender being presented as a variable, construction, or a process, whereas innovation is seen as a result, process and a discourse (Alsos et al., 2013). This complexity is expanded on by researchers (see Mitchell & Boyle, 2015; Nielsen & Nielsen, 2013; Opstrup & Villadsen, 2015) who included additional mediating and moderating variables in their models to explain the nature of the relationship between diversity and positive outcomes.

The appropriate assessment of the characteristics of employees may play an important role in gender-innovation research, as previous researchers (see Sánchez-Escobedo et al.,

2011) state that gender is significant in how the profile of the entrepreneur is observed. When constructing a survey to establish such a profile – avoiding all "male-labelled" conceptualisations of innovation, thereby using a gender-aware operationalisation of innovation – no significant difference in innovativeness was found between men and women (Nählinder et al., 2015). Alsos et al. (2013) claim that when analysing gender and innovation, *using standard assessment tools*[6], it is possible to interpret innovation as a gender-biased phenomenon. Research on innovation should consider the gender neutrality of the operationalisation used in the study (Nählinder et al., 2015). Previous research has largely ignored measurement and structural invariance, with some scholars focusing on both measurement and structural invariance (see Arbona, Fan, Schwartz, Pao, Tran, & Buser, 2019; Teo, 2019), but by far focusing mostly on measurement invariance alone (see Fergus & Bardeen, 2019; Fischer, Gibbons, Coste, Valderas, Rose, & Leplège, 2018; Henseler et al., 2016; Morton, Hill, Meiring, van de Vijver, 2019; Putnick & Bornstein, 2016).

The present research answers the call of Alsos et al. (2013), who state that it is imperative to develop and apply new methodological approaches, as well as new operationalisations, when exploring innovation and innovators. The research will address this need for modernisation by introducing measurement invariance testing in the field of gender studies, as a foundational first step before assessing predictive models.

These three reasons, explaining the rationale for the research, will be revisited in the final chapter of this thesis, where the contribution of the study is reported on.

1.6 Delineations

The delineation of the research is firstly reflected through the title, namely in the "Antecedents of innovation in organisations: A gender perspective". The focus will therefore be on innovation in organisations (intrapreneurship and not entrepreneurship), and on gender (men versus women), and not on gender diversity (the gender composition of the workforce). It will also focus on precursors to innovation, and not the consequences thereof, although it is acknowledged that outcomes may influence inputs (Dostal, Cloete, & Jaros, 2007; Kast & Rosenzweig, 1972).

[6] *Italics* added.

The study was delineated in terms of the design followed. A cross-sectional design was followed, where quantitative data were collected through surveys. Common method bias can therefore be expected. The way in which it was managed is reported on in Chapter 7, under the heading Limitations (7.4). This design was specifically selected as it is often used with success in Industrial and Organisational Psychology research. It is also well-suited for descriptive research and for studies aimed at exploring relationships between variables (Bryman 2012; Shaughnessy, Zechmeister & Zechmeister, 2012).

The extent of the literature reviews, and the general depth of the discussions in this thesis, were delineated by the format of the journals to which the research was targeted. Most of these journals stipulate a word count of no more than 7 000, which allowed for only a limited coverage of all topics. The content of Chapter 1 and Chapter 7 is intended to partially address this concern.

The study was further delineated through the instruments selected to be included for data collection. Only well-known and frequently used measures of the antecedents to innovation were included. The measures focused on diverse aspects such as the organisational climate, the leadership practices in the organisation, and the individual attributes, attitudes and behaviour of the employees. This selection was mostly based on the popularity or broad acceptance of these measures in Industrial and Organisational Psychology research. The selection was further informed by the different formats of the questions and the answers, selecting measures which display different characteristics, which may lessen the effects of common method bias (Jakobsen & Jensen, 2015). More on this will follow in Chapter 7, in the section labelled Limitations (7.4).

The study was delineated in terms of the respondents selected to participate in the study. Only full-time employees were included, as the sample frame from which random samples of employees was drawn, were the personnel records obtained from the human resource department representatives. The research included only those employees comfortable communicating in English, which is the *lingua franca* in the South African business environment and the language in which the measurements were developed and administered in the study. Only individuals with at least 12 years of schooling were included, as it was deemed that employees with this level of education would be able to comprehend and appropriately respond to the items posed in the measurement.

The study was delineated in terms of the statistical packages and techniques used to calculate the results. General descriptive and relational statistics were performed in MS-Excel and SPSS. For measurement invariance testing, the analyses were performed with the lavaan package (Rosseel, 2012) in R (R Core Team, 2013). Maximum likelihood chi-square (MLχ^2), comparative fit index (CFI), root-mean-square error of approximation (RMSEA) and Bayesian information criterion (BIC) were used to evaluate model fit across successively stringent levels of measurement invariance. The models in which the role of gender in the relationship between innovation and its antecedents was tested, were performed in SPSS, relying on the structure provided by Mackinnon (2010), which corresponds to the seminal work of Baron and Kenny (1986). This analysis was preferred above the PROSESS macro proposed by Hayes (2013), or the structural equation modelling exercise in AMOS, as the Mackinnon (2010) modelling specifies the modelling in a simple and easily digestible manner, more so than in the case of the other techniques.

1.7 Theoretical framework

From a meta-theoretical or paradigmatic perspective, a critical rationalist and logical positivist approach was adopted in this study. Critical rationalism is at the core of this research, where the researcher starts off with a biased idea[7], and compares it against reality to find out if it is right or wrong (Higgs & Smith, 2006). It may be assumed that men and women are the same, and this may be tested empirically, but even when the results are presented, we still remain sceptical on the findings. The last part of the previous sentence refers to logical positivism and falsificationism (see Hung, 1997), which are blended into this research. It is particularly well-suited for this social science enquiry.

More specifically, the relationship between antecedents to innovative work behaviour and innovative work behaviour could be explained through general systems theory. General systems theory stresses "wholeness," where systems work in totality rather than in parts (Von Bertalanffy, 1968), with an input-throughput-output model (Kast & Rosenzweig, 1972), where outputs generate the inputs that are required to maintain the system (Katz & Kahn, 1966).

[7] The bias idea is that of relativism (Adamopoulos & Lonner, 1994), where commonalities in human experience are denied and the cultural context is emphasized.

The theory accommodates a notion that antecedents influence innovative work behaviour and a feedback loop from innovative work behaviour to the antecedents (see Kast & Rosenzweig, 1972; Von Bertalanffy, 1968). General systems theory can be viewed as a deterministic model (Teece, 2018), in as much as systems and subsystems respond to each other, and in the case of this study it concerns the reciprocity between antecedents and innovative work behaviour. This can best be described as a biomatrix web, where any change has a ripple effect across the system (Dostal et al., 2007). Though professed as non-linear, the input-throughput-output premises are directional (see Wright & McMahan, 1992; Wright & Snell, 1998), pointing to specific outcomes, or a path-dependent point of view (Levy, 1994). General system theory can be applied within the workplace as a "network or system of sequential and interdependent decisions" (Cascio & Aguinis, 2014, p. 43). This approach is more useful than the behavioural theories (ability, motivation, and opportunity), or the resource-based view, which typically portrays closed systems and simple linear processes linking inputs to outputs (Shin & Konrad, 2017).

This research will not focus on gender diversity and the effects thereof on the workplace (Bell, Villado, Lukasik, Belau & Briggs, 2011; Mackey, Roth, Van Iddekinge, & McFarland, 2019). This terrain is well researched and grounded in group dynamics and interpersonal theories (Gill, Metz, Tekleab & Williamson, 2020; Schwab, Werbel, Hofmann & Henriques, 2016). The focus will rather be on the individual, and individual performance, embedded in intrapersonal dynamics and individualised explications of behaviour (Abdullah, Omar & Panatik, 2016; Amici, Widdig, Lehmann & Majolo, 2019; Woods, Mustafa, Anderson & Sayer, 2018).

At the highest level, a frequentist probability perspective with regard to statistical analyses was followed (see Hájek & Hitchcock, 2016). At an operational level, the framework for explaining the relationship between innovative work behaviour and its antecedents is informed by the theory of mediators and moderators as proposed by Baron and Kenny (1986), and operationalised by Mackinnon (2010). As stated above, this approach was preferred to the PROCESS macro's proposed by Hayes (2013), or the structural equation modelling in AMOS, as this approach is more straightforward and easier to interpret.

1.8 Research method

In this section, the research design, particulars about the participants and how they were selected, as well as the research process or procedure, are presented. This is followed by an explanation of the statistical analyses used and the way statistical decisions were made (cut-off scores). Lastly, ethical matters are clarified.

Design

A cross-sectional survey design was preferred to carry out this study. Cross-sectional designs most often involve the use of sample surveys (Zheng, 2015). Such a design is typified by the gathering of quantifiable data, at one point in time, using questionnaires, with the view of describing a population and identifying relationships within the data (Cooper & Schindler, 2003). The cross-sectional survey design was deemed sufficient, as the purpose of the study was to describe the population – and more specifically subgroups in the population (men as well as women) – and to explore relationships between variables, also across subgroups.

Participants

The target population consisted of all employees and all organisations. However, availability, accessibility, proximity and cost necessitated a focus on South African organisations. Only medium to large organisations were targeted. To gain access to these organisations, Master of Business Leaderships students were recruited to gain permission to conduct research in these organisations. In most cases access to organisations was granted based on the students' relationships with specific organisations, which in most cases meant that they were employed at these organisations. The sampling of companies was therefore based on convenience. Only medium to large organisations were targeted, as it was presumed that formalised processes existed in these organisations and that these organisational features might make reporting more uniform. The organisations eventually included in the study represented a broad spectrum of government and private sector companies.

In these selected organisations, employees who could report on their perceptions about their own behaviour, as well as on their respective organisations' organisational processes, were targeted. This introduced the only excluding condition in the sampling of participants: Only those who could converse in English at a Grade 12 level, were included, as this level of education is generally deemed sufficient to comprehend and appropriately respond to the survey items which were presented in English. Otherwise, the target population consisted of all employees, irrespective of race, ethnicity, gender, or levels of responsibility. Participants (employees) were randomly selected from personnel lists provided by the participating organisations. In each of the organisations, random samples were drawn until complete data were collected to achieve the target of 60 participants. Although the sampling process was not perfect, it gravitated towards a random sample. The selection of participants was therefore as random as possible, given the operational realities of recruiting participants.

The final number of the participants reflected in the different analyses varies slightly, depending on the number of complete cases available for each particular analysis. With all the samples analysed, the total number of participants came to more than 3 100, with the gender composition always favouring men; i.e. around 1 750 men and 1 350 women. Data were in all cases available across all 52 organisations included in the study. The distribution of participants with respect to race or ethnicity was consistent across all the analyses, with about 8 per cent Asian, 58 per cent Black, 8 per cent of mixed ethnicity, and 24 per cent White. Participants' ages ranged between 20 and 72 years ($M \approx 38$, $SD \approx 9$). Participants' tenure at their present organisations ranged from 1 month to 42 years, with an average of around 8 years ($SD \approx 7$). The participants therefore represented a broad spectrum of South African employees.

Research process / procedure

The research process and analyses were systematically designed, starting with the analysis of invariance among antecedents before the dependent variable, dealing with single antecedents before dealing with the antecedents as a group, and finally bringing antecedents and the dependant variable together.

The first step in conducting the empirical research was the collection of appropriate data. The data were collected in compliance with the requirements of the research ethics committee, through a process that will be discussed later in this chapter. The target population was all South African employees.

Given the available data, the candidate acquainted himself with the literature on measurement invariance after which the supervisor guided him in performing tests of measurement invariance on the first independent variable. This resulted in the first article, in which the factorial validity of the Human Resource Practices Scale in South Africa is reported on, focussing on measurement invariance across gender, and testing for invariance at five levels, namely configural, metric, intercept, strict and latent means level. Next, the measurement invariance across gender of the Brief Corporate Entrepreneurship Assessment was analysed, also testing for invariance at five levels. This resulted in the second article.

The focus then shifted to the dependent variable, namely innovation, or more specifically Innovative Work Behaviour (Kleysen & Street, 2001). Consensus on the factorial structure of the instrument has not been reached (see Hebenstreit (2003), Kleysen and Street (2001), Lu and Li (2010), and Wojtczuk-Turek and Turek (2013), and therefore an investigation into the validity of the instrument was necessary before including it in this study. Five different factorial models were tested to determine the structure of the construct. These were a single factor, an orthogonal five-factor orthogonal, a correlated five-factor, a higher second order five-factor model, as well as a bi-factor model. The findings are reported in Article 3.

Given the confidence the candidate developed through publishing these two articles, an article was drafted where the measurement invariance results of the first mentioned two instruments were reported (Human Resource Practices Scale and Brief Corporate Entrepreneurship Assessment), combined with additional analyses of the four selected measures of antecedents to innovation, as well as innovative work behaviour itself. The aim was to identify which instruments were measurement invariant, and to eliminate any non-invariant instruments from the final analyses where only measurement invariant variables would be used to predict innovative work behaviour. The aim of this article was also to identify characteristics specific to instruments which are measurement invariant and non-invariant. These findings are reported in Article 4.

The final step of the empirical research involved testing how gender measurement invariant constructs relate to each other, measuring relationships between these constructs across gender. Firstly, correlations between variables across gender were investigated, and later more complex models[8] were used, performing regressions across gender. Finally, models with gender as a moderating variable between qualifying antecedents and the dependant variable were considered. These analyses addressed the fourth and ultimate empirical objective of the study, namely to empirically investigate the effect of antecedents to innovation on innovative behaviour from a gender perspective. These results are presented in Chapter 6 (Article 5).

The research was concluded by linking all five articles in a comprehensive manner to the research aim, and reporting on the challenges experienced, as well as providing recommendations for future research. The concluding chapter turned out to be very interesting, as the (unexpected) outcomes were plentiful and insightful.

Statistical analyses

The statistical analyses served three main objectives, namely to assess the suitability of the data for analysis, to test for measurement invariance across gender, and lastly to test the relationships between the independent and dependant variables. SPSS (IBM SPSS Statistics, 2017), and R (R Core Team, 2013), with the lavaan package (Rosseel, 2012), were mostly used to perform these analyses, and Excel was used to do manual calculations (such as calculating effect-size).

Standard descriptive statistics were calculated, included per gender means and standard deviations, as well as the kurtosis and skewness of the different sub-scale and scale scores. Within the context of SPSS, significant deviations from normality occur when the skewness/standard error of skewness or kurtosis/standard error of kurtosis has an absolute value greater than 2 (Weinberg & Abramowitz, 2008). Some researchers (Field, 2009) are

[8] The original intention was to perform structural equation modelling, comparing models generated for men and women. This idea was abandoned when it became apparent that the mediator variables were not measurement invariant across gender. It was then decided to follow the regression route, as this interpretation is straightforward and makes pinning down effects easier.

more lenient, setting the cut-off at values below 3.29. In the case of this thesis skewness or kurtosis values greater than 3 were interpreted as significantly deviating from normality.

Measurement invariance was tested by following the recommendations of Vandenberg and Lance (2000), which require pairwise multigroup confirmatory factor analyses with a robust maximum likelihood estimation (Wu, Li, & Zumbo, 2007), testing for invariance at configural, metric, intercept, and strict levels, including equivalence at the latent means level. The analyses were performed, as alluded to above, using the lavaan package (Rosseel, 2012) in R (R Core Team, 2013). With the testing for measurement invariance, attaining a non-significant χ^2-statistic is highly unlikely (Millsap, 2011; Schermelleh-Engel, Moosbrugger, & Müller, 2003; Vandenberg, 2006), particularly given the relatively large size of this sample, and therefore the significant χ^2-statistic was not used as a decisive indicator of model fit. Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), Comparative Fit Index (CFI), Root-Mean-Square Error of Approximation (RMSEA), as well as changes in CFI (ΔCFI) and changes in RMSEA (ΔRMSEA), were instead used to test for model fit. The selection of the particular indices was informed by the outputs that the selected software (i.e. R) produced. Models with the lowest AIC and BIC values were judged as the best fitting models (Schermelleh-Engel, Moosbrugger, & Müller, 2003; Van de Schoot, Lugtig, & Hox, 2012). CFI values > .90 were judged adequate and (leniently/lenient) RMSEA values < .08 as acceptable (Hair, Black, Babin, & Anderson, 2009; Van de Schoot et al., 2012). With regard to both ΔCFI and ΔRMSEA, a decrease greater than .01 was seen as an indicator of a deteriorating model, with decreases greater than .02 seen as a clear sign of differences between the models (Vandenberg & Lance, 2000).

Testing the relationship between the independent variables and IWB involved calculating the correlations between the variables for both men and women. Z-observed scores were calculated to determine if these correlations differed significantly from each other (Field, 2009). Z-observed scores higher than (+/-) 1.96 were interpreted as indicative of a significant difference between the correlations, at p<.01 (Pallant, 2013). When Z-observed scores were smaller than (+/-) 1.64, it was assumed that the differences in the correlations were not significant.

Still on the matter of relationships, regression analyses were performed where the subcomponents of the different measures were used as predictors of IWB, splitting the file

along gender lines, with the aim of testing whether the models fitted equally well for men and women (considering the coefficient of determination – R^2). The aim was to also identify possible differences in the extent to which the different subcomponents predicted IWB, again along gender lines. In assessing differences across regression models, a R^2>.02 difference was deemed as indicative of a significant difference. Subcomponents were deemed similar when the significance of the loadings (the beta values) was similar. As the sample sizes were relatively large (N>1 000), the more stringent cut-off of p<.01 was used to indicate significance.

When tested for moderation, the procedures suggested by Mackinnon (2010) were used. This method is well aligned with the well-known structure suggested by Baron and Kenny (1986). This involves performing regression analyses only using the independent variable to predict IWB (Model 1), then adding the moderator (in this case gender; Model 2), and finally adding the moderator and the interaction between the independent variable and the moderator (independent variable x moderator; Model 3). Using Model 1 as a baseline model, a positive and significant ΔR^2 across models (ΔR^2>.02) suggests improved models. Hereafter the significance of the beta values (p<.01) was interpreted. Should gender directly predict IWB (Model 2), this was seen as indicative of a direct effect, signifying gender as an antecedent to IWB, indicating that the intercepts of the regression lines differed per gender. When the interaction between gender and any predictor was found to be significant (p<.01) (Model 3), this was deemed indicative of gender moderating the relationship between that independent variable and IWB. This denotes that the slopes of regression lines differ along gender lines. In sum, ΔR^2>.02 and beta scores with p<.01 were considered as significant.

Ethical matters

Following receipt of permission from the Research Ethics Review Committee of the Graduate School of Business Leadership (GSBL) at the University of South Africa (2014_SBL_018_CA dated 27 February 2014) for the research to continue, Master of Business Leadership (MBL) students were recruited as research assistants to collect data. They were requested to target relatively large organisations, where they could have access to at least 60 employees. The organisations were therefore entered into the study through convenient sampling. Once

approval to conduct the research within the organisations was obtained from the respective leaders of the organisations, a list of employees was obtained from each organisation's human resources department and participants were selected randomly from the list. The selected/prospective participants were invited to a meeting at which the purpose and the procedures of the research were explained. Employees were informed as to the nature of their participation, including the fact that participation was completely voluntary. Those who agreed to participate were then provided with a consent form which detailed all the customary ethical issues, including confirmation regarding the anonymity and confidentiality, the right to withdraw from participation at any time without any explanation or any adverse effects, and the fact that the data would be used for research purposes only. Following consent, hard copies of the questionnaires were handed to the participants. No data which could identify the participants were collected. Following the collection of the data at the different organisations, it was captured by the research assistants, and merged into the database used for this study by the principal investigator – the PhD candidate. No adverse effects were reported, nor incidents which could possibly threaten the integrity of the data collection process. The validity of the ethics certificate was confirmed on 10 January 2019 by the chairperson of the ethics committee.

1.9 Chapter division

Chapter 2 to Chapter 6 report on Article 1 to Article 5, where each chapter will be dedicated to one specific article. Chapter 7 will deal with closing remarks, which include a summation of the thesis results and a discussion of the conclusions drawn from this research. The limitations of the study, as well as the recommendations, will also be presented in Chapter 7. This document will close with the presentation of a consolidated reference list and, finally, a collection of annexures relevant to this work.

CHAPTER 2: INVESTIGATING THE VALIDITY OF THE HUMAN RESOURCE PRACTICES SCALE IN SOUTH AFRICA: MEASUREMENT INVARIANCE ACROSS GENDER

Presented from the next page is the article with the following reference:

Steyn, R., & de Bruin, G. (2018a). Investigating the validity of the Human Resource Practices Scale in South Africa: Measurement invariance across gender. *SA Journal of Human Resource Management, 16*, 10 pages. doi:https://doi.org/10.4102/sajhrm.v16i0.1038

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Article 1: Investigating the validity of the Human Resource Practices Scale in South Africa: Measurement invariance across gender

Abstract

Orientation: The effective delivery of human resource management (HRM) services is often associated with positive organisational outcomes, including innovation. Within the context of HRM service delivery, as well as within the scope of innovative behaviour, gender differences are often researched.

Research purpose: To effectively research the role of HRM services in organisations, including the effects thereof on innovation, instruments that yield valid and invariant measures for men and women are required.

Motivation for the study: To date no measurement invariance research on the Human Resource Practices Scale (HRPS), with reference to gender, could be located. Researchers and practitioners alike should be hesitant to use the HRPS without such information.

Research approach/design and method: A cross-sectional quantitative survey design was used. The present study addressed the measurement invariance for the HRPS across men and women, applying pairwise multigroup confirmatory factor analyses with robust maximum likelihood estimation to examine four levels of measurement invariance across the groups. Data from 2936 employees, representing 52 South African organisations, were used.

Main findings: Results support the construct validity of the HRPS and demonstrate strict measurement invariance for the HRPS across gender, which implies that the HRPS yields scores with equivalent meaning, measurement units and measurement precision for men and women.

Practical/managerial implications: It will therefore be possible to test hypotheses regarding mean differences between men and women as well the relationship between the effective delivery of HRM services and positive organisational outcomes without fear that the HRPS will yield gender-biased results.

Contribution/value-add: The research demonstrates that the items of the HRPS are valid for both men and women, suggesting that men and women have similar experience of the workplace. This finding should advance debate and research regarding the segregated delivery of HRM services and gender matters in general.

Introduction

Gender (used in this text to refer to men and women) is a prominent variable within the workplace and life in general. Several journals are dedicated to the topic (see Gender, Work, and Organisations [Wiley], Gender in Management: An International Journal [Emerald Publishing], as well as the International Journal of Gender and Entrepreneurship [Emerald Insight]). In some articles published in these journals the perceptions of men and women are

compared, or measures of perceptions are used in models to test hypotheses related to gender differences (Eagly, 1997; Eagly & Wood, 1999), often reporting differential outcomes based on gender.

At a societal level, the Constitution of the Republic of South Africa (Act 106 of 1996), and particularly the Bill of Rights, and at a workplace level, the Employment Equity Act (Act 55 of 1998), promote equity, equal opportunity and fair treatment, specifically including gender as a source of unfair discrimination. Though constituted, gender bias remains a source of tension at many work sites (Koch, D'Mello, & Sackett, 2015) and it is often suggested that discrimination is directed against women (Eagly & Karau, 2002; Ismail & Nakkache, 2015). According to Stamarski and Son Hing (2015), discrimination transpires in organisational structures and processes, which in turn affects human resource management (HRM) practices. HRM practices are those practices traditionally associated with HRM functions, ranging from job design to service termination (Albrecht, Bakker, Gruman, Macey, & Saks, 2015). Within this context, some authors report that gender discrimination exists widely, regardless of gender equality policies (Patterson, Bae, & Lim, 2013). The persistence of gender inequality makes it therefore important to see gender inequality in organisations as a complex phenomenon (Stamarski & Son Hing, 2015) – one that requires sophisticated models if it is to be explained (Lips, 2013). Lee Cooke and Xiao (2014) also express their concern and state that observed gender differences have serious repercussions for HRM practices, affecting job design, work organisation, career support, as well as work-life balance enterprises.

Despite the aforementioned concerns, Dickens (1998) states that most writing and research on HRM does not make gender noticeable (except when the primary submission concerns women at work or equal opportunities) and that writing and research on the nature and perceptions regarding HRM practices tend to be gender-blind. In such writings employees are usually presented as disembodied. As Acker (1992, p. 259) notes, the 'fiction of the universal worker obscures the gendered effects of ostensibly gender-neutral processes and helps banish gender from theorising about the fundamental character of complex organisations'. Dickens (1998) concludes that assuming equality across genders in the HRM domain forms part of grandiloquence rather than the reality and states that apparently gender-neutral HRM concepts and policies are in reality gendered and perpetuate, rather than contest, gender inequality.

Focusing on human capital models, Lips (2013) states that there is a continuing debate in which various explanatory variables are used to explain the gender differences in workplace outcomes, arguing that many of the differences are the result not of discrimination but of other factors such as the different contributions men and women make in the workplace. Most significant for this research is Lips's (2013) questioning of the utility or validity of many of the human capital 'explanatory' variables, stating that they (the explanatory variables) beg explanation themselves.

Purpose

This research aims to analyse the validity of a measurement of HRM practices across men and women, testing if respondents interpret the measure in a conceptually similar manner. Stated more operationally, the research aims to test whether the relationships between manifest indicator variables (scale items, subscales) and the underlying construct are the same across groups (Bialosiewicz, Murphy, & Berry, 2013). The focus on measurement is important, as the Employment Equity Act (Act 55 of 1998) prohibits the use of instruments that have not been scientifically tested to demonstrate that they can be applied fairly to all employees and are not biased to any group. The focus on HRM practices is also important, as it is a major antecedent of organisational culture and knowledge management practices, leading to organisational innovation that is positively related to organisational performance (Al-bahussin & El-Garaihy, 2013). Furthermore, this research has been prompted by the work of Ismail and Nakkache (2015), who explored gender differences in the experiences of HRM policies and whose results disaffirm the stereotypical pro-men conceptualisations.

Literature review

Two matters are reviewed. Firstly, the contention that HRM practices constitute an antecedent to organisational outcomes is considered, and secondly the focus will be on ways in which HRM practices are measured. This review grounds the present research within the context of the present body of knowledge.

HRM practices can positively influence employees' attitudes and lift workplace performance, which will most likely affect organisational outcomes (Kehoe & Wright, 2013; Messersmith, Patel, Lepak, & Williams, 2011). Research has highlighted the role of effective HRM practices in organisational effectiveness (Combs, Liu, Hall, & Ketchen, 2006; Melton & Meier, 2017; van

Esch, Wei, & Chiang, 2016). Brewster, Gooderham and Mayrhofer (2016) state that the bulk of HRM research focuses on strategic HRM, implying an emphasis on the impact of HRM on organisational performance. It is therefore not surprising that the Chartered Institute of Personnel and Development (2016) encourages debate on how HRM can amplify its contribution toward organisational performance or that Ulrich (2013, p. 16) urges executives to 'see their human resource practices as a source of competitive advantage' and a deliverer of results.

The outcomes associated with effective HRM practices are not limited to organisational performance as a singular concept. Links have also been found with flow (Kasa & Hassan, 2013), employee engagement (Albrecht et al., 2015), employee satisfaction (Prayogo, Pranoto, & Purba, 2017), organisational commitment (Chambel, Castanheira, & Sobral, 2016) and retention (Denkins, 2013), to mention only a few. Increasingly, researchers have focused on the vital association between HRM and corporate entrepreneurship (Dabic, Ortiz-De-Urbina-Criado, & Romero-Martínez 2011; Schmelter, Mauer, Börsch, & Brettel, 2010; Zhang & Jia, 2010). The HRM–corporate entrepreneurship link has been established using both qualitative methodologies (Amberg & McGaughey, 2016; Denkins, 2013; Llego, 2015) and quantitative methodologies (Ahmed, 2016; Boadau & Gil-Ripoll, 2009; Mustafa, Richards, & Ramos, 2013).

When considering quantitative methodologies, the measurement of constructs is important. Focusing specifically on the measurement of high-performance or effective HRM practices, some authors develop their own measures (e.g. Madmoli, 2016; Zhang & Jia, 2010; Ziyae, 2016) while others prefer to use standardised measures, such as the one developed by Sun, Aryee and Law (2007) (e.g. Ahmed, 2016; Mustafa, Lundmark, & Ramos, 2016; Zhu, Warner, & Rowley, 2007) or Gould-Williams and Davies (2005) (e.g. Alfes, Shantz, & Truss, 2012; Boekhorst, Singh, & Frawley, 2015; Jensen, Patel, & Messersmith, 2011). In this research, the focus will be on the Human Resource Practices Scale (HRPS) (Nyawose, 2009; Steyn, 2012), a measure of effective HRM practices previously successfully used in the South African workplace, displaying acceptable reliability and validity properties (Steyn, Bezuidenhout, & Grobler, 2017; Steyn & Grobler, 2014).

Some researchers prefer to present measurement of high-performance or effective HRM practices as a single construct (e.g. Makongoso, Gichira, & Orwa, 2015; Tang, Wei, Snape, & Ng, 2015; Zhang & Jia, 2010), and this is how Becker, Huselid and Becker (1998) present it in their seminal paper. Others, however, perceive it as a multidimensional construct. In this regard, Sun et al. (2007) list broad job design, selective staffing, internal mobility, employment security, extensive training, results-oriented appraisal and rewards, as well as employee participation, as elements of the construct. Boadau and Gil-Ripoll's (2009) instrument assesses elements named values and culture, job, internal communication, training, appraisal of diligence and performance, recruitment and selection, pay, induction and exit processes, workforce planning, climate and motivation, teamwork, change, leadership, industrial relations and career plan. As a last example, Madmoli (2016) lists the following as elements to be assessed when one is interested in effective HRM: selection, training, job evaluation, rewarding, employees' participation in current affairs, hiring competent experts, as well as the tendency of managers to share implicit and explicit knowledge among themselves. The HRPS (Nyawose, 2009; Steyn, 2012) (the instrument used in this research) assesses seven HRM practices, namely training and development, compensation and rewards, performance management, supervisor support, staffing, diversity management, as well as internal communication.

It may be important to note that the evaluation of HRM practices depends on the degree to which employees experience HRM practices as effective (Kehoe & Wright, 2013). Building on this, and seeing the matter in the context created in the second and third paragraphs of this literature review, this research aims to analyse the extent to which men and women perceive concepts, as presented in the HRPS instrument (Nyawose, 2009; Steyn, 2012), equivalently. The focus on measurement invariance stems from the comparisons often drawn between men and women, something that also happens in entrepreneurship research (Haus, Steinmetz, Isidor, & Kabst, 2013; Henry, Foss, & Ahl, 2016; Lim & Envick, 2013) and when researching the HRM practices that act as antecedents to entrepreneurship (Amberg & McGaughey, 2016; Dabic et al., 2011; Mustafa et al., 2013). To date no research on the invariance across gender of the HRPS has been published, and this matter is thus unresolved.

This research did not attempt to explain differences between men and women through identifying the most potent explanatory variables. Rather, it focused on the validity of the

explanatory variables themselves, as Lips (2013) urges researchers to do. When asking questions regarding invariance, it takes into account whether differences in scores are real and whether the functioning of the measuring instruments is indeed equivalent for men and women. In some cases, instruments have indeed been found to function differently for males and females (Pässler, Beinicke, & Hell, 2014; Wetzel, Böhnke, Carstensen, Ziegler, & Ostendorf, 2013), while in other cases no such differentiation was noted (Baker, Caison, & Meade, 2007; Wei, Chesnut, Barnard-Brak, Stevens, & Olivárez Jr, 2014). Within the context of HRM practices, some research has been conducted regarding the differential functioning of measures of individual HR practices across men and women (Matthews & Ritter, 2016; Ployhart & Holtz, 2008; Xu, Wubbena, & Stewart, 2016), but no research could be located on measurement invariance in HRM practices scales that focus on multiple practices, nor on the HRPS. Ignoring the possibility of deferential functioning has the potential to compromise any substantive gender-based comparisons resulting from the measurement (Salzberger, Newton, & Ewing, 2014). More so, the National Institute of Education and American Psychological Association Standards lists differential validity and differential prediction as a major concern of test fairness (Pässler et al., 2014). Only once construct comparability (measurement invariance) is demonstrated does it become possible to interpret differences in test or scale scores as true representations of differences explained by group membership (Wu, Li, & Zumbo, 2007). The aforementioned is in line with the requirements of the South African Employment Equity Act (Act 55 of 1998), which takes a strong stance against the adverse impact of psychometric testing.

Research design

This study examines the HRPS structure across 1652 men and 1284 women employees of 52 companies in South Africa. Full data were available across all of the companies concerned. All applicants completed the HRPS in English (which is the lingua franca of high school and post-school education, as well as of business, in South Africa). The objectives of the study were (1) to examine if the HRPS structure could be replicated across gender groups, (2) to examine the level of measurement invariance attained across the groups and (3) to report on the psychometric properties of the HRPS when used in South African organisations.

The matter of measurement invariance is central to this research and to this article. Measurement invariance relates to an observed score being reflective of an individual's standing on a construct, independent of his or her group membership (Mellenbergh, 1989; Meredith, 1993; Meredith & Millsap, 1992; Wu et al., 2007). Within the context of factor analysis, measurement invariance means that the same latent variables are measured across groups, allowing for cross-group factor scores to be comparable (Meredith, 1993; Wu et al., 2007). Typically four levels of measurement invariance are tested: (1) configural invariance, which tests if groups (men and women) have similar factor loading patterns; (2) weak invariance, testing for equality in unstandardised factor loadings; (3) strong invariance, testing for equal unstandardised factor loadings and intercepts (of the item regressions); and (4) strict invariance, testing for equal unstandardised factor loadings, intercepts and error variances (Vandenberg & Lance, 2000). As a final step, equivalence of the latent means of men and women on the seven factors was tested. Multigroup confirmatory factor analysis is the *de facto* standard (Chen, 2008) for use in investigating measurement invariance.

Method

Population and sampling

The target population consisted of employees, at different levels of responsibility, who are exposed to various HRM practices. Organisations with more than 50 employees were targeted as it was presumed that the HRM services would be formalised in these organisations and that a broad range of services would be available.

Measurement instrument

The HRPS (Nyawose, 2009; Steyn, 2012) was used to measure employees' satisfaction with the HRM services delivered to them. The items were developed on a rational basis by examining the literature on HRM (Nyawose, 2009). Seven HRM practices were measured in this study, and the questionnaire consisted of 21 items. The HRPS has a hierarchical structure, with each of the seven factors consisting of three items (see Appendix 1).

Participants responded to the items on a five-point Likert scale, ranging from 'disagree strongly' (1) to 'agree strongly' (5). For each of the seven HRM practices, the scores ranged from 3 to 15. A high score would be reflective of an individual who perceived the HRM practice

as effective, whereas a low score would reflect that the participant was dissatisfied with the particular HRM practice. Nyawose (2009) reported internal consistency reliabilities varying from 0.74 to 0.93. Nyawose also reported statistically significant correlations with outcomes such as turnover intentions and occupational commitment. Steyn (2012), only using five of the HRPS scales, reported Cronbach's alphas of 0.88 for training and development, 0.87 for compensation and rewards, 0.81 for performance management, 0.74 for staffing and 0.75 for diversity management. Steyn (2012) also reported significant correlations with turnover intentions and occupational commitment, and additionally with job satisfaction and employee engagement. Overall, these results support the reliability and validity of the HRPS for research use.

Participants

The participants were 2936 employees (44.7% women), representing several public and private organisations based in South Africa. The distribution of participants with respect to race and ethnicity was approximately as follows: 8% Asian, 58% black people, 8% mixed ethnicity and 24% white people. The participants' ages ranged between 20 and 72 years, with a mean of 37.8 years and with a standard deviation of 9.1. Participants' tenure at their present companies ranged from 1 month to 42 years, with an average of just more than 9 years and a standard deviation of 7.5 years.

Analysis

The data were initially scanned for normality, after which measurement invariance was tested for. Following the recommendations of Vandenberg and Lance (2000), pairwise multigroup confirmatory factor analyses (Wu et al., 2007) with robust maximum likelihood estimation were used to examine configural, weak, strong and strict invariance across men and women, and as a final step equivalence of the latent means of men and women on the seven factors was tested.

The analysis only focused on measurement differences between self-identified men and women. This divide (mainly) represents the biological sex and more traditional gender role identification prevalent in the South African society. It is acknowledged that in the present era gender identification is more fluid and that identification as a lesbian, gay, bisexual or transgender (LGBT) individual may have more negative consequences (Badgett, Lau, Sears, &

Ho, 2007; Grant, Mottet, Tanis, Harrison, Herman, & Keisling, 2011) than being labelled as a man or a woman. Granting this, the present custom in South Africa is to identify as a man or a woman in most formal organisational settings, and this custom was therefore followed in this study.

The analyses were performed with the lavaan package (Rosseel, 2012) in R (R Core Team, 2013). Maximum likelihood chi-square (MLχ^2), comparative fit index (CFI), root-mean-square error of approximation (RMSEA) and Bayesian information criterion (BIC) were used to evaluate model fit across successively stringent levels of measurement invariance. Findings are as follow:

Although highly desirable, it was expected that the hypotheses of perfect fit for the measurement models would be rejected, given that the χ^2 statistic is very sensitive to sample size (in this case more than 3000) and is no longer relied upon as a basis for acceptance or rejection of a model fit (Schermelleh-Engel, Moosbrugger, & Müller, 2003; Vandenberg 2006). However, a statistically significant difference in χ^2 between a less constrained and a more constrained model was deemed as evident of a deteriorating model fit.

A CFI > 0.95 is used as indicative of a good model fit (Vandenberg & Lance, 2000). When comparing models, Vandenberg and Lance (2000, p. 46) note that 'changes in CFI of -0.01 or less indicate that the invariance hypothesis should not be rejected, but when the differences lie between -0.01 and -0.02, the researcher should be suspicious that differences exist. Definite differences between models exist when the change in CFI is greater than -0.02'.

Vandenberg and Lance (2000) suggest that a RMSEA < 0.08 is acceptable. RMSEA < 0.08 was used as indicative of overall fit. As no critical values for the change of RMSEA could be located, the same principles as for ΔCFI were followed, where consecutive model fits were compared.

The BIC was used as a measure of comparative fit. Models that generate lower BIC values are generally preferred, and the absolute value was not interpreted. BIC was therefore used to assess model deterioration, which was visible when BIC values increase.

These parameters were used when interpreting the measurement invariance results. Once measurement invariance is established, more descriptive statistics on the HRPS will be provided. These will include the factor loadings, descriptive statistics, including reliability

information, as well as the correlations between the observed scores as well as the latent factors. Last-mentioned will provide insight into the uni- or multidimensionality of the measurement of HRM practices.

Ethical consideration

Permission (2014_SBL_018_CA dated 27 February 2014) to conduct the research was obtained from the Research Ethics Review Committee of the Graduate School of Business Leadership at the University of South Africa before commencing with sampling. Once approval had been obtained, a list of staff members was requested from the organisation's HRM department. Respondents were selected randomly from this list. The selected respondents were invited to a meeting at which the purpose of the research was explained. They were informed as to the nature of their participation, including that participation was completely voluntary. Those who agreed to participate then completed a consent form specifying ethical issues, including confirmation regarding the anonymity of participation, confidentiality, the right to withdraw from participation at any time without any explanation or any adverse effects, and the fact that the data would be used for research purposes only. Then only did they complete a hard copy of the questionnaire.

Results

Preliminary analysis showed that the skewness and kurtosis of the HRPS items ranged from -0.08 to -0.97 and -0.99 to 0.79, respectively. None of the items demonstrated excessive deviation from normality and they appeared appropriate for factor analysis with robust maximum likelihood estimation (cf. Loehlin & Beaujean, 2017; McDonald & Ho, 2002).

In each group, a baseline independent cluster confirmatory factor analysis model was specified in accordance with the structure given in Appendix 1. The baseline models were identified by fixing the unstandardised factor loading of one item per targeted factor to unity. Factor loadings of items on non-target factors were fixed at zero. Factor loadings of the remaining items, factor covariances and error variances were freely estimated using robust maximum likelihood. MLχ^2, CFI, RMSEA and BIC were used to evaluate model fit. The results pertaining to BIC and χ^2 changes are presented in Table 1.

TABLE 1: Chi-square test and change in chi-square statistics.

Invariance level	*df*	BIC	χ^2	$\Delta\chi^2$	Δdf	Δp
Configural	336	160 436	1341	-	-	-
Weak (loadings)	350	160 343	1359	18.5	14	0.1867
Strong (intercepts)	364	160 243	1371	12.0	14	0.6095
Strict (residuals)	385	160 115	1411	39.5	21	0.0085*
Equal latent means	392	160 060	1411	0.7	7	0.9984

Source: Authors' own work.
*$p < 0.01$; BIC, Bayesian information criterion.

As expected, the hypothesis of perfect fit for the configural invariance model was rejected ($\chi^2(326) = 1341$, $p < 0.001$). However, as evident from Table 2, fit to the configural model as measured with CFI (= 0.97) and the RMSEA (= 0.045) suggested a good fit.

TABLE 2: Fit measures and changes in fit measures.

Invariance level	CFI	RMSEA	ΔCFI	ΔRMSEA
Configural	0.97	0.045	-	-
Weak (loadings)	0.97	0.044	0.000	0.001
Strong (intercepts)	0.97	0.043	0.000	0.001
Strict (residuals)	0.97	0.043	0.001	0.001
Equal latent means	0.97	0.042	0.000	0.001

Source: Authors' own work.
CFI, comparative fit index; RMSEA, root-mean-square error of approximation.

Tables 1 and 2 encapsulate the changes in fit across successively more stringent measurement invariance models with respect to the BIC, CFI and RMSEA. For each comparison, very small ΔCFI and ΔRMSEA values were found (≤ 0.001 for all comparisons – see Table 2). The lowest RMSEA and BIC values were observed for the strict invariance model (i.e. equal loadings, intercepts and error terms), suggesting that this model has the best chance of being successfully replicated in future studies.

As a final step, the constraint of equal latent means across men and women was added, producing a statistically non-significant $\Delta\chi^2$ ($p = 0.998$). In addition, the ΔCFI and ΔRMSEA of ≥ 0.001 and ≥ 0.001, respectively (see Table 2), indicated that the latent means of the males and females could be treated as equal.

Against the background of the support yielded by the ΔCFI and ΔRMSEA for strict measurement invariance, Table 3 shows the standardised factor loadings obtained for the total group (n = 2936). Each factor was well defined and each item was a statistically significant ($p < 0.001$) indicator of its target factor. Standardised loadings varied from 0.89 to 0.54.

TABLE 3: Standardised factor loadings of the Human Resource Practices Scale items for men and women jointly.

Item	Factor						
	T&D	Rem	PM	SS	Sta	Div	Comm
1	0.85	-	-	-	-	-	-
2	0.84	-	-	-	-	-	-
3	0.73	-	-	-	-	-	-
4	-	0.64	-	-	-	-	-
5	-	0.89	-	-	-	-	-
6	-	0.84	-	-	-	-	-
7	-	-	0.80	-	-	-	-
8	-	-	0.79	-	-	-	-
9	-	-	0.61	-	-	-	-
10	-	-	-	0.70	-	-	-
11	-	-	-	0.88	-	-	-
12	-	-	-	0.82	-	-	-
13	-	-	-	-	0.77		
14	-	-	-	-	0.54	-	-
15	-	-	-	-	0.70	-	-
16	-	-	-	-	-	0.75	-
17	-	-	-	-	-	0.77	-
18	-	-	-	-	-	0.57	-
19	-	-	-	-	-	-	0.74
20	-	-	-	-	-	-	0.85
21	-	-	-	-	-	-	0.80

Source: Authors' own work.

Note: All factor loadings are statistically significant ($p < 0.05$).

T&D, training and development; Rem, remuneration; PM, performance management; SS, supervisor support; Sta, staffing; Div, diversity management; Com, communication.

Noting that latent means were assessed to be invariant, descriptive statistics on the observed HRPS construct scores for men and women and reliability coefficients are presented in Table 4.

TABLE 4: Scale means, standard deviations and reliability coefficients on the Human Resource Practices Scale per gender.

Variable	Men			Women		
	Mean	SD	Cronbach α	Mean	SD	Cronbach α
T&D	11.35	2.99	0.845	11.31	2.95	0.853
Rem	9.03	3.09	0.834	8.96	3.15	0.852
PM	9.99	2.79	0.787	9.96	2.76	0.784
SS	10.58	2.89	0.835	10.52	2.97	0.853
Sta	10.12	2.70	0.735	10.07	2.62	0.710
Div	10.18	2.67	0.742	10.18	2.64	0.763
Comm	11.35	2.99	0.841	11.31	2.95	0.844

Source: Authors' own work.
T&D, training and development; Rem, remuneration; PM, performance management; SS, supervisor support; Sta, staffing; Div, diversity management; Com, communication.

The range of the Cronbach's alpha reliability coefficients of the HRPS scales varied from 0.73 and 0.84 for men and 0.71 and 0.85 for women. The reliabilities of the seven scales were uniformly satisfactory and similar across men and women. Given the evidence in support of strict measurement invariance these reliabilities can be assumed to be invariant across the groups. As a last step the correlations between the latent constructs as well as the scale scores were calculated and are presented in Table 5.

TABLE 5: Factor and scale correlations of the Human Resource Practices Scale.

	T&D	Rem	PM	SS	Sta	Div	Comm
T&D	(0.85)	0.46	0.49	0.41	0.45	0.45	0.49
Rem	0.51	(0.79)	0.65	0.44	0.51	0.48	0.52
PM	0.56	0.78	(0.75)	0.55	0.54	0.54	0.63
SS	0.45	0.47	0.61	(0.84)	0.46	0.44	0.51
Sta	0.55	0.62	0.68	0.55	(0.84)	0.58	0.54
Div	0.53	0.56	0.65	0.52	0.72	(0.73)	0.60
Comm	0.56	0.56	0.73	0.56	0.65	0.71	(0.84)

Source: Authors' own work.
Note: Factor correlations are below the diagonal. Scale correlations are above the diagonal. Coefficient alphas are on the diagonal, in parentheses. All correlations are statistically significant ($p < 0.05$).
T&D, training and development; Rem, remuneration; PM, performance management; SS, supervisor support; Sta, staffing; Div, diversity management; Com, communication.

Across the groups, medium-sized correlations between factors were observed, which points to some, but not excessive, overlap of the seven factors. This affirms the interrelatedness of the HRM functions (see Becker et al., 1998) but shows that each scale measures a distinct aspect of HRM practices.

Discussion

The objectives of the study were (1) to examine if the HRPS structure could be replicated across gender groups, (2) to examine the level of measurement invariance attained across men and women and (3) to report on the psychometric properties of the HRPS when used in South African organisations.

The results of the maximum likelihood χ^2 suggest that the hypothesis of perfect fit for all the measurement models had to be rejected (see Table 1). The CFI and RMSEA evidenced that the degree of misfit across the models was relatively small (see Table 2). This suggests that the HRPS structure could be replicated across gender groups, at a configural or baseline level (Objective 1).

The ΔCFI values in Table 2 revealed no detectable deteriorations in fit across successively stringent levels of measurement invariance (note that the CFI does not take model complexity into account). The ΔRMSEA values showed improved fit with successively stringent models. Indeed, the RMSEA and BIC, which both take model complexity into account, showed that the strict measurement invariance model yielded the best fit (see Table 2). Taken together, these results suggest that a measurement model with invariant factor loadings, intercepts and error variances for men and women is the most likely to be replicated across different studies. This also suggests that the highest level of invariance was achieved (Objective 2). Furthermore, the additional test of latent mean equality was met, which supplements the notion of invariance across men and women.

In conducting this research the seldom-answered call for questioning the assumption of measurement invariance (Tsaousis & Kazi, 2013) was answered. These results are similar to the studies that found invariance when applying the same instrument to men and women (Baker at al., 2007; Wei et al., 2014; Xu et al., 2016), suggesting that males and females are no different when they interpret the items of these instruments. As in the case of many other instruments, the HRPS showed high levels of invariance, implying that gender differences in

this regard are not significant. The statistics (Objective 3) presented in Table 4 reflect this equivalence.

The research also affirms the multidimensional conceptualisation of HRM practices, as presented by Nyawose (2009) and Steyn (2012). Contrary to the seminal work of Becker et al. (1998), and many others (Makongoso et al., 2015; Tang et al., 2015; Zhang & Jia, 2010) who perceive HRM functioning as unidimensional, this research demonstrated that the HRM practices are distinct. This is in line with the conceptualisations of Boadau and Gil-Ripoll (2009), Madmoli (2016) and Sun et al. (2007). As far as measurement is concerned, the multidimensionality of HRM practices affirmed here implies that items need to be assigned to each HRM practice, which requires longer questionnaires than when HRM practices are presented as unidimensional.

Practical implications

This study contributes to addressing limitations in the existing literature and practice through validating the factorial structure of the HRPS and its invariance across the gender spectrum. The results empower industrial psychologists in South Africa to use the HRPS to assess the level at which employees are satisfied with the delivery of HRM services across gender. The HRPS is now in compliance with the specifications of the Employment Equity Act (Act 55 of 1998), specifying that gender comparisons be scientifically shown to be fair and not biased to either group. Doing cross-gender comparisons is to be a matter of interest for practitioners involved in HRM efficiency, as some may be interested in reporting on discrimination related to gendered structures and practices.

The distribution of men and women in the sample presents an over-representation of women when considering the demographics of the South African workforce (Statistics South Africa, 2016). A further limitation is that the elements included in the HRPS may not comprehensively describe the entire HRM function. Both these matters should be taken into consideration when using the instrument. While the focus of this research was on traditional gender-centred differences, and the possible differential treatment of men and women, it should be noted that discrimination against LGBT individuals is rife and considerable (Badgett et al., 2007; Grant et al., 2011). The magnitude of the reported discrimination against LGBT

individuals as compared to those in more traditional gender roles should promote debate and research on differences in workplace experiences based on gender-related matters.

Conclusion

The results provide ample evidence of measurement invariance of the HRPS across gender in the workplace context in South Africa and also support the veracity and stability of the elements among job incumbents in South Africa. After establishing measurement invariance, it will be appropriate for researchers to proceed with testing substantial hypotheses about the means and interrelations between these latent constructs across groups (Hirschfeld & von Brachel, 2014).

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Competing interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Authors' contributions

R.S. constructed the research as part of his doctoral degree and therefore wrote the concept paper. G.d.B was the supervisor of the study and assisted in doing the statistical analysis and writing the final manuscript.

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Appendix A

Constructs and items of the Human Resource Practices Scale

Construct	#	Item
Training and development	1	My company is committed to the training and development needs of its employees.
	2	Employees are encouraged to accept education and training within the company.
	3	This organisation has provided me with training opportunities enabling me to extend my range of skills and abilities.
Remuneration	4	My salary and benefits have been an adequate return for the time and energy demanded of me.
	5	I am satisfied with my company reward system to compensate good performance.
	6	The company's compensation and reward system encourages team and individual contributions.
Performance management	7	My company's performance management system is fair and based on clear objectives at the beginning of the term/year.
	8	The company has provided enough information regarding specific methods of the performance evaluation system.
	9	Employees are allowed to formally communicate with supervisors/managers regarding the appraisal results.
Supervisor support	10	My supervisor would personally use his/her power to help me solve my work problems.
	11	My supervisor always gives credit and encourages an employee for a job well done.
	12	My supervisor often lets me know how well he/she thinks I am performing the job.
Staffing	13	Proper company procedures and processes are always followed when staffing/recruitment decisions are made.
	14	Interview panels are used during the staffing process in this organisation.
	15	All appointments in this organisation are based on merit (i.e. the best person for the job is selected, regardless of their personal characteristics).
Diversity management	16	The company spends enough time and effort on diversity awareness related to race, gender and religion.
	17	Management is supportive of cultural difference in this organisation.
	18	People living with disabilities have employment opportunities in this organisation.
Communication	19	My company regularly provides information sharing sessions to all employees.
	20	Continuous improved communications between management and staff is stated as an important company objective and is being practiced.
	21	My company's communication channels are open and effective in dealing with matters that are relevant to employees.

Source: Nyawose, M. (2009). The relationship between human resources management practices, organisational commitment and turnover intentions amongst engineering professionals. Unpublished master's thesis, University of South Africa, Pretoria, South Africa and Steyn, R. (2012). Human resource practices and employee attitudes: A study of individuals in ten South African companies. *Alternation, 5*, 184-167.

CHAPTER 3: THE STRUCTURAL VALIDITY AND MEASUREMENT INVARIANCE ACROSS GENDER OF THE BRIEF CORPORATE ENTREPRENEURSHIP ASSESSMENT INSTRUMENT

Presented from the next page is the article with the following reference:

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Article 2: The structural validity and measurement invariance across gender of the Brief Corporate Entrepreneurship Assessment Instrument

Abstract

Background: Corporate entrepreneurial activity and innovation are presented as essential elements of organisational success, and gender diversity is often seen as an important variable in this context. The efficient measurement of these variables is essential to the management thereof. It is within this context that the Brief Corporate Entrepreneurship Assessment Instrument (BCEAI) was developed. Shorter instruments seem to be favoured by researchers and practitioners alike. However, little is known about the psychometric properties of the BCEAI, particularly regarding measurement invariance.

Aim: This study seeks to address the structural validity and measurement invariance for the BCEAI applied for men and women. The objective was to establish the utility of the instrument within the South African context, with specific emphasis on cross-gender comparisons.

Setting: Medium to large South African organisations, with more than 60 employees, were targeted for inclusion in the study. Once organisations indicated their willingness to participate, 60 employees per organisation were randomly selected to participate in the study.

Methods: Data on the BCEAI were captured and pairwise multigroup confirmatory factor analyses with robust maximum likelihood estimation were used to examine four levels of measurement invariance, as well as the equivalence of latent means pertaining to male and female respondents.

Results: Data were collected from 3180 employees representing 52 South African organisations. The results support the structural validity of the BCEAI and demonstrate strict measurement invariance for the BCEAI across gender. Equivalence of latent means across gender was also supported.

Conclusion: These results reveal that the BCEAI mirrors the structure of the original instrument in the South African context and that BCEAI yields psychometrically equivalent scores among employees of both genders. Researchers and practitioners can therefore use the BCEAI with the knowledge that its theoretical structure is sound and can apply it with confidence when comparing male and female employees in the workplace.

Introduction

This article addresses the important matter of the accurate assessment of the entrepreneurial environment within organisations, as perceived by employees. This topic is important as organisational success is dependent on innovation, and the accurate assessment of the entrepreneurial environment, which fosters such behaviour, is necessary should any interventions be planned. The issue is complicated by the debate about gender differences as

far as innovation is concerned, and it may therefore be asked if men and women perceive the organisational environment in the same manner. This study will focus on the last-mentioned matter.

The focus on gender in the assessment of the entrepreneurial environment stems from the comparisons often drawn between men and women. Although numerous attempts have been made to explain differences in men's and women's attitudes and intentions, the extent to which these differences are due to the assessment thereof is less often considered. It may well be asked if these differences are real, or whether the measuring instruments do not function equivalently for men and women. In some cases, instruments have indeed been found to function differently for men and women (Pässler, Beinicke & Hell 2014; Wetzel et al. 2013), while in other cases no such differentiation was noted (Baker, Caison & Meade 2007; Wei et al. 2014). Within the context of entrepreneurship, Zampetakis et al. (2017) report that gender differences, at the item level, regarding entrepreneurial attitudes, perceived behavioural control, subjective norms and entrepreneurial intentions, are almost non-existent and negligible. However, ignoring the possibility of deferential functioning has the potential to compromise any substantive gender-based comparisons resulting from the measurement (Salzberger, Newton & Ewing 2014). More so, the National Institute of Education and American Psychological Association Standards lists differential validity and differential prediction as a major concern of test fairness (Pässler et al. 2014). Only once construct comparability (measurement invariance) is demonstrated does it become possible to interpret differences in test or scale scores as true representations of differences explained by group membership (Wu, Li & Zumbo 2007).

In this research, structural validity and measurement invariance across gender of the Brief Corporate Entrepreneurship Assessment Instrument (BCEAI) was tested, using five consecutive hypotheses related to similar factor loading patterns, unstandardised loadings, intercepts, error variances and latent means. The objectives were to examine if the BCEAI structure could be replicated across gender groups, and to examine the level of measurement invariance attained across the groups. Evidence on the BCEAI deferential functioning across male and female respondents is not presently available. The aim of this study was to produce such evidence, focusing on medium to large South African organisations, gathering data from random employee samples.

The literature review follows, focusing primarily on the characteristics of the Corporate Entrepreneurship Assessment Instrument (CEAI; Hornsby, Kuratko & Zahra 2002). The literature review starts by explaining the importance of entrepreneurship and an entrepreneurial climate to organisational success. This is followed by a detailed discussion of the CEAI's psychometric properties, as well as some data collected on the BCEAI by Strydom (2013). Attention then shifts towards gender differences and the literature review is concluded with a discussion of the concept of measurement invariance. The method used in the study is provided, followed by a presentation of the empirical results. The obtained results are then discussed and the limitations of the research acknowledged. Lastly, conclusions are drawn on the structural validity and gender-specified measurement invariance of the BCEAI, given this sample.

Literature review

Organisational performance is an imperative indicator of organisational success and one of the most important key variables in management research (Stegerean & Gavrea 2010). Research indicates that organisational performance is affected by innovation (e.g. Durán-Vázquez, Lorenzo-Valdés & Moreno-Quezada 2012; Likar, Kopa & Fatur 2014; Nybakk & Jenssen 2012; Oke, Walumbwa & Myers 2012). It is important for organisations to undertake research on the antecedents to innovation so as to allow managers to take note of the potency of different predictors of organisational performance, as well as to manage these in an effective manner (Bigliardi 2013; Ndregjoni & Elmazi 2012). Yen (2013) also makes this link and states that the facilitation of innovation is an essential management function which is directly linked to organisational performance.

An important element with regard to innovation is organisational climate (Nusair 2013; Panuwatwanich, Stewart & Mohamed 2008). Some scholars (e.g. Björkdahl & Börjesson 2011; Lin & Liu 2012; Zhang & Begley 2011) have reported a distinct relationship between organisational climate and innovation. According to Hamidianpour et al. (2015), organisational climate denotes the employee's perceptions about the organisation's reward system, leadership credibility, organisational policy and its formal and informal procedures – as well as, ultimately, his or her sense of belonging in and trust of the organisation. Along similar lines, Padmaja (2014) argues that organisational climate includes the provision of

challenging jobs to employees, the provision of a good working environment, the creation of acceptable career paths and the leadership styles adopted in the organisation, including participation in decision-making.

Hornsby et al. (2002) are important authors with regard to the conceptualisation and measurement of organisational climate associated with innovation in the workplace. The Hornsby et al. (2002) measure of entrepreneurial climate (CEAI) is often both referred to and used (Bhardwaj 2012; Brazeal, Schenkel & Kumar 2014; De Villiers-Scheepers 2012; Hajipour & Mas'oomi 2011; Holt, Rutherford & Clohessy 2007; Hornsby et al. 2013; Karimi et al. 2011; Kuratko & Audretsch 2013; Marzban, Seyed & Ramezan 2013; Nikolov & Urban 2013). This instrument measures five constructs typically found in organisational climate surveys, namely the level of management support, work discretion/autonomy, rewards and reinforcement, time availability and organisational boundaries (Hornsby et al. 2002).

The focus of this research was on investigating the validity of the BCEAI, a truncated version of the CEAI, proposed by Strydom (2013), specifically with reference to measurement invariance across gender. The validity of cross-gender comparisons is important in assisting to address philosophical issues, such as the fundamental feminist philosophical questions, which include assertions that women are equal to men, different from men, or superior to men (Mikkola 2016). Another reason for investigating the invariance in cross-gender comparisons is the numerous studies that proclaim that such differences, based on group membership, exist in the workplace. Authors suggest, for example, that there are significant differences between men and women with regard to how they manage and express stress and emotions (Bennie & Huang 2010). Authors also suggest variations based on group differences with regard to health or safety risks in the workplace (Mühlau 2011), differences concerning interest in communal factors (Frame et al. 2010), as well as differences in work scheduling (Cascio 2015; Robbins & Judge 2011). Important within the context of this research is the role that gender plays in organisational innovation. While some researchers have found a link between gender diversity and innovation in the workplace (Adams & Ferreira 2009; Deloitte 2013; Francoeur, Labelle & Sinclair-Desgagné 2008; Jiménez, Fuentes-Fuentes & Ruiz-Arroyo 2014), research also suggests that this does not occur in all situations (McMahon 2010; Parrotta, Pozzoli & Pytlikova 2014). Sonfield et al. (2001), as well as Kvidal and Ljunggren (2014), found no differences. The last mentioned report actually states that gender is a non-

issue in terms of innovation. The research referred to in this paragraph affirms the use of gender as a variable in the work and innovation environment. In addition, the mixed findings point to a need for further research, including the investigations regarding methodology, measurement, and the validity of measurement – which constitutes the focus of this research.

The CEAI (Hornsby et al. 2002) was used as a basis to develop BCEAI. As mentioned earlier, the CEAI measures five constructs, namely the level of management support, work discretion or autonomy, rewards and reinforcement, time availability, and organisational boundaries (Hornsby et al. 2002). Considerable work has been published on the factor structure and reliability of the CEAI. Hornsby et al. (2002) reported a five factor CEAI solution, which yielded Cronbach's alpha coefficients of 0.92, 0.86, 0.75, 0.77 and 0.69 for management support, discretion or autonomy, rewards and reinforcement, time availability and organisational boundaries respectively. The results did not fully support organisational boundaries as an important factor as it marginally failed to meet the set threshold of $\alpha = 0.70$. Kamffer (2004) reported alphas of 0.88, 0.80, 0.62, 0.71, and 0.77 for management support, discretion or autonomy, rewards and reinforcement, time availability and organisational boundaries respectively. In this study, rewards and reinforcement did not meet the 0.70 threshold. An analysis of the CEAI by Holt et al. (2007) demonstrated support for four factors: management support, work discretion or autonomy, rewards and reinforcement and time availability. The coefficient alphas of these factors were 0.92, 0.91, 0.82, and 0.77 respectively. Again, organisational boundaries failed to meet the 0.70 threshold.

The questionnaire used in this study, as proposed by Strydom (2013), consisted of 20 items. The length of the CEAI (i.e. 48 items) triggered the development of the BCEAI (Strydom 2013). In a similar manner to the CEAI, the BCEAI proposes a hierarchical structure with each of the five factors consisting of four items (see Table 1). The items were selected from the original questionnaire, based on the individual item factor loadings on the particular targeted factor (Strydom 2013). The four items with the highest loading per factor were retained, based on the Hornsby et al. (2002) findings. The aspiration was that the BCEAI would yield psychologically equivalent factors to the CEAI, with acceptable reliabilities.

TABLE 1: Constructs and items of the Brief Corporate Entrepreneurship Assessment Instrument.

Construct	#	Item
Management support	1	Individual risk takers are often recognised for their willingness to champion new projects, whether eventually successful or not.
	2	People are often encouraged to take calculated risks with new ideas around here.
	3	Many top managers have been known for their experience with the innovation process.
	4	This organisation supports many small and experimental projects realising that some will undoubtedly fail.
Work discretion or autonomy	5	It is basically my own responsibility to decide how my job gets done.
	6	I almost always get to decide what I do in my job.
	7	I have the freedom to decide what I do in my job.
	8	I have much autonomy in my job and am left on my own to do my own work
Rewards and reinforcement	9	My manager would tell his boss if my work was outstanding.
	10	My supervisor will increase my job responsibilities if I am performing well in my job.
	11	My supervisor will give me special recognition if my work performance is especially good.
	12	The rewards I receive are dependent upon my work on the job.
Time availability	13	I have just the right amount of time and workload to do everything well.
	14	I feel that I am always working with time constraints on my job.
	15	I always seem to have plenty of time to get everything done.
	16	During the past 3 months, my work load was too heavy to spend time on developing new ideas.
Organisational boundaries	17	I clearly know what level of work performance is expected from me in terms of amount, quality and timeliness of output.
	18	In my job I have no doubt of what is expected of me.
	19	There is little uncertainty in my job.
	20	In the past 3 months, I have always followed standard operating procedures or practices to execute my major tasks.

Source: Hornsby et al. 2002; Strydom 2013.

The CEAI items are presented as statements, such as the following: 'Individual risk takers are often recognised for their willingness to champion new projects, whether eventually successful or not'. Respondents respond to the statements on a standard Likert scale. A high score on any particular subscale would be suggestive of a climate that is favourable to entrepreneurial activity, and a low score would suggest circumstances that impede entrepreneurial activity. An overall high score would be indicative of the existence of a positive entrepreneurial climate. The five constructs, as well as the four items representing each of the constructs, are presented in Table 1.

The reliability of the subscales and the total questionnaire are reported by Strydom (2013) as 0.73, 0.82, 0.74, 0.68, and 0.57 for management support, discretion or autonomy, rewards and reinforcement, time availability and organisational boundaries. As in previous research, organisational boundaries failed to meet the threshold of 0.70. The reliability of the total scale was 0.81. These reliabilities appear adequate for research purposes, but results with respect to the organisational boundaries scale need to be viewed with caution, given the low Cronbach's alpha value reported.

Strydom (2013) reported that the covariance of these items was adequately explained by five factors. Each item loaded on factors as expected and all factor loadings were higher than 0.50. No cross-loadings were observed. This would suggest that the BCEAI has factorial validity.

In the present study, the focus will be on whether the BCEAI (Strydom 2013) mirrors previous findings about the CEAI (Hornsby et al. 2002) in non-Western contexts and whether scores on these factors are comparable across gender groups. Some evidence with regard to the replicability of the CEAI structure in a Western context (Holt et al. 2007; Hornsby et al. 2002) is reported, while evidence in the non-Western context seems mixed, with Kamffer (2004) replicating the structure and Van Wyk and Adonisi (2011) failing to do so among African participants. To date, however, no study has comprehensively examined measurement invariance of the CEAI among employees across different gender groups. This is also true as far as the less-used BCEAI is concerned.

The matter of measurement invariance is central to this research. Measurement invariance relates to an observed score being reflective of an individual's standing on a construct, independent of their group membership (Mellenbergh 1989; Meredith 1993; Meredith &

Millsap 1992; Wu et al. 2007). Within the context of factor analysis, measurement invariance means that the same latent variables are measured on the same scale (metric) across groups, allowing for cross-group factor scores to be comparable (Meredith 1993; Wu et al. 2007). Multigroup confirmatory factor analysis is the *de facto* standard for use in investigating the degree to which measures are invariant across groups (Chen 2008).

Five consecutive hypotheses will be tested in this research. These are that men and women have: (1) similar factor loading patterns, (2) equal (unstandardised) factor loadings, (3) equal factor loadings and intercepts, (4) equal factor loadings, intercepts, as well as error variances and (5) equivalence of the latent means, when responding to BCEAI items.

Method

A cross-sectional survey design was used to generate data to test the structural validity and measurement invariance of the BCEAI across gender.

Setting

The target population was all employees. However, availability, accessibility, proximity and cost necessitated a focus on South African organisations. Only organisations with more than 60 employees were targeted. The setting was therefore medium to large organisations, based in South Africa, to which access was granted. All participants completed the BCEAI in English (which is the lingua franca of high school and post-school education, as well as of the business milieu, in South Africa).

Instrument

The BCEAI (Strydom 2013), as discussed in detail above, was used in the study.

Procedure

Within organisations random sampling was therefore done. Each fieldworker advised participants as to the nature of their participation. Those who agreed to participate then completed a hard copy of the questionnaire and handed it back to the respective fieldworkers. Most employees were willing to participate. Those unwilling to participate were replaced, using the same list from which the original 60 participants were drawn.

Analysis

Following the recommendations of Vandenberg and Lance (2000), pairwise multigroup confirmatory factor analyses (Wu et al. 2007) with robust maximum likelihood estimation were used to examine four levels of measurement invariance across men and women: (1) configural invariance (similar pattern of freely estimated and fixed factor loadings), (2) weak invariance (equal unstandardised factor loadings), (3) strong invariance (equal unstandardised factor loadings and intercepts) and (4) strict invariance (equal unstandardised factor loadings, intercepts, and error variances) (Vandenberg & Lance 2000). As a final step, equivalence of the latent means of men and women on the five factors was tested.

Ethical consideration

Following receipt of permission from the Research Ethics Review Committee of the Graduate School of Business Leadership (GSBL) at the University of South Africa for the data to be collected, Master of Business Leadership (MBL) students were recruited as fieldworkers to collect data. They were requested to target relatively large organisations where they could have access to at least 60 employees who had a sufficient command of English to complete the instruments in a meaningful way – as the instruments were administered in English. The collection of organisations presented in this study was therefore the product of a convenient sample. Once approval to conduct the research within the organisations was obtained, a list of staff members was obtained from each organisation's human resource department and participants were selected randomly from the list.

Results

The participants were 3180 employees, representing 52 South African organisations. This study examines the BCEAI structure across 1771 men and 1372 women employees, with 37 participants providing incomplete information. Data were available across all of the companies concerned. The distribution of participants with respect to race or ethnicity was as follows: 8.3% Asian people, 58.4% black people, 8.4% mixed race people, and 24.6% white people (missing data = 0.3%). Participants' ages ranged between 20 and 72 years (M = 37.80, SD = 9.11). Participants' tenure at their present companies ranged from 1 month to 42 years, with an average of 8.39 years (SD = 7.47).

A preliminary analysis was performed to ensure that no violations of the assumptions of normality were committed. The skewness and kurtosis coefficients of the BCEAI items ranged between –1.08 and 0.45 for skewness, and –1.15 and 1.16 for kurtosis. Overall, the data appeared appropriate for factor analysis with maximum likelihood estimation.

Analyses were performed with the lavaan package (Rosseel 2012) in R (R Core Team 2013). In each group, a baseline independent cluster confirmatory factor analysis (IC-CFA) model was specified in accordance with the structure given in Table 1. The baseline models were identified by fixing the unstandardised factor loading of one item per targeted factor to reflect unity. Factor loadings of items on non-target factors were fixed to reach zero. Factor loadings of the remaining items, factor covariances and error variances were freely estimated using robust maximum likelihood. The maximum likelihood chi-square (MLχ^2), Bayesian information criterion (BIC), comparative fit index (CFI) and root mean square error of approximation (RMSEA) were used to evaluate global fit.

TABLE 2: Chi-square test and change in chi-square statistics.

Invariance level	Df	BIC	χ^2	$\Delta\chi^2$	Δdf	Δp
Configural	320	173 986	1322	-	-	
Weak	335	173 908	1364	42.0	15	0.0002
Strong	350	173 830	1406	42.4	15	0.0002
Strict	370	173 694	1431	25.1	20	0.1973
Equal latent means	375	173 664	1441	9.4	5	0.0938

Source: Authors' own work.

According to the MLχ^2 the hypotheses of perfect fit for all models were rejected ($p < 0.001$). However, the CFI suggested marginally good fit across all the models and the RMSEA suggested good fit.

TABLE 3: Fit measures and changes in fit measures.

Invariance level	CFI	RMSEA	ΔCFI	ΔRMSEA
Configural	0.92	0.045	-	-
Weak	0.91	0.045	0.002	0.000
Strong	0.91	0.044	0.002	0.000
Strict	0.91	0.043	0.000	0.001
Equal latent means	0.91	0.043	0.000	0.000

Source: Authors' own work.
CFI, comparative fit index; RMSEA, root mean square error of approximation.

Table 2 and Table 3 summarise the changes in fit across successively more stringent measurement invariance models with respect to the BIC, CFI and RMSEA. For each comparison, very small ΔCFI and ΔRMSEA values were found (≤ 0.002 for all comparisons; see Table 3). The lowest RMSEA and BIC values were observed for the strict invariance model (i.e. equal loadings, intercepts and error terms), suggesting that this model has the best chance of being successfully replicated in future studies.

As a final step, we added the constraint of equal latent means across men and women, producing a statistically non-significant $\Delta\chi^2$ ($p = 0.094$). In addition, the ΔCFI and ΔRMSEA values greater than 0.001 (see Table 3) indicated that the latent means of the male and female respondents could be treated as equal.

Against the background of the support yielded by the ΔCFI and ΔRMSEA for strict measurement invariance, Table 4 shows the standardised factor loadings obtained for the total group ($n = 3.143$). Each factor was well defined and each item was a statistically significant ($p < 0.001$) and satisfactory indicator of its target factor. Three items with standardised factor loadings less than 0.30 were observed (i.e. Item 14 and Item 16 on the factor time availability, and Item 19 on the factor organisational boundaries).

TABLE 4: Standardised factor loadings of the Brief Corporate Entrepreneurship Assessment Instrument items for men and women jointly.

Variable	Factor				
	Management support	Work discretion	Rewards	Time availability	Organisational boundaries
i1	0.60	–	–	–	–
i2	0.68	–	–	–	–
i3	0.61	–	–	–	–
i4	0.48	–	–	–	–
i5	–	0.56	–	–	–
i6	–	0.79	–	–	–
i7	–	0.79	–	–	–
i8	–	0.51	–	–	–
i9	–	–	0.47	–	–
i10	–	–	0.40	–	–
i11	–	–	0.74	–	–
i12	–	–	0.63	–	–
i13	–	–	–	0.86	–
i14	–	–	–	0.25	–
i15	–	–	–	0.56	–
i16	–	–	–	0.28	–
i17	–	–	–	–	0.73
i18	–	–	–	–	0.71
i19	–	–	–	–	0.28
i20	–	–	–	–	0.35

Source: Authors' own work.

Note: Values are rounded to two decimal places. All factor loadings are statistically significant ($p < 0.05$).

The correlations between the factors ranged from 0.25 (work discretion and time availability) to 0.61 (management support and rewards) (see Table 5). The range of the Cronbach's alpha reliability coefficients of the BCEAI traits across the genders was 0.67 for men and 0.68 for women on management support (4 items), 0.74 for men and also 0.74 for women on work discretion or autonomy (4 items), 0.65 for men and 0.61 for women on rewards and reinforcement (4 items), 0.57 for men and 0.60 for women on time availability (4 items) and 0.53 for men and 0.60 for women on organisational boundaries (4 items). The Cronbach's alpha reliability coefficients of the total BCEAI were 0.76 (20 items), with 0.76 for men and 0.75 for women respectively. The reliabilities of the five factors were uniformly similar in

strength across the sexes and, given the evidence in support of strict measurement invariance, these reliabilities can be assumed to be invariant across the groups.

TABLE 5: Factor and scale correlations of the Brief Corporate Entrepreneurship Assessment Instrument.

Variable	Managerial support (MS)	Work discretion (WD)	Rewards (RW)	Time availability (TA)	Organisational boundaries (OB)
MS	(0.68)	0.29	0.41	0.13	0.24
WD	0.36	(0.74)	0.28	0.09	0.23
RW	0.61	0.36	(0.64)	0.11	0.27
TA	0.32	0.25	0.33	(0.59)	0.09
OB	0.37	0.27	0.40	0.29	(0.57)

Source: Authors' own work.

Note: Factor correlations are below the diagonal. Scale correlations are above the diagonal. Coefficient alphas are on the diagonal and shown in brackets. Values are rounded to two decimal places. All correlations are statistically significant ($p < 0.05$).

Across the groups, weak covariance between factors was observed, which points to the independence of the different factors.

Discussion

Due to the interest in gender as a differentiating variable in the workplace, and particularly the availability of statistical technology to test gender-based differences in responding to psychological testing, this study set out to test whether the BCEAI structure mirrors the CEAI in non-Western contexts and whether scores on these factors are comparable across gender groups. The results are discussed below, with specific reference to the theoretical and practical implications, as well as to the contribution of this study to the present body of knowledge.

According to the maximum likelihood chi-square test, the hypothesis of perfect fit for all the measurement models had to be rejected (see Table 2). However, the CFI and RMSEA values evidenced that the degree of misfit across the models was relatively small (see Table 3). The ΔCFI values in Table 3 revealed negligible deteriorations in fit across successively stringent levels of measurement invariance (note that the CFI does not take model complexity into account). The ΔRMSEA values showed improved fit with successively stringent models.

Indeed, the RMSEA and BIC, which both take model complexity into account, showed that the strict measurement invariance model yielded the best fit (see Table 3). Taken together, these results suggest that a measurement model with invariant factor loadings, intercepts and error variances for men and women is likely to best replicate across different studies. The additional test of latent mean equality was also met, which supplements the notion of invariance. Overall, the results of this study indicated that despite differences in gender, participants responded to the items on the BCEAI in a similar manner.

This study contributes towards addressing limitations in the existing literature of innovation climate measurement as the results support the construct validity of the BCEAI elements among South African men and women. Strydom (2013) showed the replication of the CEAI/BCEAI structure in a heterogeneous (men and women combined) South African group. The results of the present study reflect additionally that strict measurement invariance is achieved, which implies that scores on the BCEAI can be compared across the gender groups. Moreover, the results also show equivalence of latent means scores across factors. This signals that the latent mean scores of men and women do not differ significantly, implying that any critique towards Strydom (2013) for neglecting gender as a moderator would be unfounded.

The results portray a picture contrary to the perception of certain individuals or groups who see gender as a differentiating factor in the entrepreneurial domain (e.g. Jiménez et al. 2014), but are considered to be aligned to the findings of other researchers (e.g. Kvidal & Ljunggren 2014), who suggest gender to be a non-issue when predicting innovation. These empirical results could have repercussions for feminist philosophers and theory regarding gender, as the study does not report any significant differences in the ways men and women perceive this aspect in the workplace.

The results of this study also have implications for organisational assessment practices. Since strict measurement invariance was achieved, researchers and practitioners may use scores on the BCEAI to compare individuals across gender groups, knowing that the responses should not be affected by gender-based response biases.

Lastly, the replication results also permit researchers in South Africa to capitalise on existing theoretical and empirical knowledge about the CEAI (Hornsby et al. 2002). The Hornsby et al.

(2002) structure of internal environment for corporate entrepreneurship is widely followed, with more than 1000 citations, and abundant knowledge has been created around their conceptualisation of the organisational environment. The knowledge about the replication of this structure in the South African context provides a fertile base to conduct additional empirical work with South African samples.

Limitations

As with most research endeavours, the present study has a number of limitations that need to be considered when interpreting the results. Firstly, the organisations employed for the study were targeted in terms of convenience and availability, limiting generalisability to all South African organisations. Although this is a limitation, it would be difficult to mitigate, as proposing any sample frame representative of a country would be contentious, and not all organisations included in the sample frame would be willing to participate in the study. The present sample presents an overrepresentation of women when considering the demographics of the South African workforce (Statistics South Africa 2016). This overrepresentation of women in the sample was deemed to be an effect of the present sample, and it was thus not controlled for. A further limitation is that the reliability coefficients reported in the study are low – in fact substantially lower than those reported by Strydom (2013) during the development of the BCEAI. This places a damper on the results. The low reported reliabilities is likely to inhibit the use of the instrument.

Conclusion

The results provide ample evidence of measurement invariance of the BCEAI across gender in the workplace context in South Africa and also support the veracity and stability of the CEAI model among job incumbents in the country. The results further suggest that it is warranted for researchers and practitioners to tap into the accumulated wealth of empirical and theoretical knowledge associated with the CEAI model. After establishing measurement invariance, it will be appropriate for researchers to proceed with testing substantial hypotheses about the means and interrelations between latent constructs across groups (Hirschfeld & Von Brachel 2014). This will advance enquiries into the evaluation of entrepreneurial climate, the prediction of innovation, as well as studies directed towards the identification of gender as a moderator in this context.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

Both authors contributed to the conceptualisation of the article with R.S. mainly responsible for the literature review and conclusions and G.P.d.B. responsible for the statistical analysis and discussion of the results.

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CHAPTER 4: THE STRUCTURAL VALIDITY OF THE INNOVATIVE WORK BEHAVIOUR QUESTIONNAIRE: COMPARING COMPETING FACTORIAL MODELS

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Article 3: The structural validity of the innovative work behaviour questionnaire: Comparing competing factorial models

Abstract

Background: Innovation is about central organisational sustainability and is fundamentally centred in individuals.

Aim: Understanding and building theory on innovative work behaviour (IWB), as well as the parallel measurement thereof, is a prerequisite to the development of models for enhancing IWB. Most theorists propose IWB as a sequential process involving steps such as exploration, generativity, investigation, championing and application. These steps are also reflected in the design of IWB measurements. In this study, the theorised step-structure of IWB, as proposed by Kleysen and Street (2001), is tested – relying on general descriptive statistics and applying exploratory and confirmatory factor analyses, with five different factorial structures tested.

Setting: Employed men and women, capable of reporting on their perception of the workplace, across several South African organisations, were included in the study.

Methods: Complete records for more than 3000 respondents on the IWB measure were available. The results revealed that exploration and generativity occur more often than investigation, championing and application, alerting theorists to the dwindling effect of creative ideas and also to the hierarchical nature of the steps embedded in IWB. With regard to structure, the results revealed that the IWB steps were correlated, not orthogonal, and unlikely to be sequential as theorised. The initial steps of IWB (exploration and generativity) are therefore linked to the latter steps (investigation, championing and application), implying that employees are cognisant of the latter steps when engaging in the former.

Results: The results of this study suggest reconsidering the segmented stepwise thinking regarding IWB. It also has important practical implications for stimulating IWB: Enabling individuals to manage the latter 'steps' of the IWB may well encourage the creativity and curiosity associated with the former 'steps'.

Conclusion: The research provides important insights into the nature of IWB, informing theoretical models using data-driven information.

1. Introduction

According to literature, there is consensus on the fact that innovation constitutes a key source of competitiveness, and that it forms an essential element of organisational success (Bos-Nehles, Renkema & Janssen 2017; Sanz-Valle & Jiménez-Jiménez 2018; Veenendaal 2015). The task of effecting innovation is often left to the research and development departments (Scott & Bruce 1994). Unlike the case of those who work in research and development teams, innovative behaviour by general employees is often perceived as an extra role or as a

discretionary action, and is often not formally, directly or even indirectly recognised in organisations (Janssen 2000). However, motivating general employees to implement innovative work behaviour (IWB) should be an important task of managers, as previous research has identified the management practices that inspire such employee behaviours (Bos-Nehles et al. 2017; Sanz-Valle & Jiménez-Jiménez 2018; Veenendaal 2015). This may be essential to an organisation's sustainability.

The conceptualisation, as well as valid measurement of IWB, is disparate. Without the exact conceptualisation and accurate measurement of IWB, models and theories on precursors to IWB, as well as the benefits of IWB, cannot be tested empirically. Although most prominent theorists on IWB (De Jong & Den Hartog 2010; Janssen 2000; Kleysen & Street 2001; Scott & Bruce 1994) perceive IWB as a sequence of activities (stages), they differ on how they define the broad construct, and subsequently also the number of stages it comprises. Perhaps, most alarming is the fact that the theorised concepts do not materialise as discrete stages when tested empirically (De Jong & Den Hartog 2010; Janssen 2000; Kleysen & Street 2001; Scott & Bruce 1994), with researchers identifying less complexity than theoretically proposed, often reporting a single construct to be representative of IWB. Scott and Bruce (1994) explain the measurement of IWB as only a single construct because of the fact that innovation is characterised by discontinued activities, where employees may be involved in several of these activities simultaneously. De Jong and Den Hartog (2010), as well as Janssen (2000), reference Scott and Bruce (1994)'s explanation, when they account for finding less complex models.

In this paper, the evolution of the IWB concept will be discussed with reference to the way the concept is defined, conceptualised (as a multi-stage process) and measured. The model of IWB, as proposed by Kleysen and Street (2001), will be tested, based on a sample size much larger than the one used in the original study, and using five competing fit models, compared to the single model used in the original study. Kleysen and Street (2001) only tested for a five-factor model, whilst in this study additional tests were run for a higher second-order model, an orthogonal five-factor model, a bi-factor model, as well as a single factor model.

This article contributes to the IWB literature in two ways. Firstly, it presents a detailed conceptualisation of the complex concept of IWB and portrays how it is presented and measured by some of the most prominent researchers in this field. Secondly, it exposes the

structure of IWB, incorporating the theorised structure proposed by Kleysen and Street (2001) using five different modelling techniques. This paper provides a deeper insight into the factors that make up IWB, and could be considered as relevant, as it provides a more coherent picture of IWB and how it is measured.

The paper consists of five parts. Firstly, existing literature relevant to IWB is reviewed, specifying how IWB is defined, conceptualised and measured. Next, the research method is offered and the data analysis techniques are explained. Then the results are presented and summarised. This is followed by a discussion of the results, linking the results to the literature. The paper concludes with a discussion of the theoretical and managerial implications, as well as by providing directions for future research.

2. Literature review

The literature review focusses on the seminal IWB work by De Jong and Den Hartog (2010), Janssen (2000), Kleysen and Street (2001), as well as Scott and Bruce (1994). Whilst focussing on these authors, the valuable work of Farr and Ford (1990), Kanter (1988), as well as West and Farr (1989) is acknowledged. In the first part of this literature review, definitions of the IWB concept will be presented and analysed. Next, the proposed structure of IWB will be presented. The measurement of IWB will then be discussed, together with some psychometric properties of the different proposed instruments.

2.1. Definitions of innovative work behaviour

The definitions of IWB provided below build on each other and are in many ways related, with the later researchers often referring to earlier attempts to define IWB. Scott and Bruce (1994) do not define innovation explicitly in their article, but rather conceptualise it as something more than creativity, where the distinction is substance. They state that creativity relates to the production of novel and useful ideas, whereas innovation has to do with the production or adoption of beneficial ideas and idea implementation. It is therefore not only novelty and new knowledge but also incorporates the reworking of products or processes, and bringing the idea into effect. Janssen (2000:288) defines IWB as 'the intentional creation, introduction

and application of new ideas within a work role, group or organization, in order to benefit role performance, the group, or the organization'. Later, Janssen (2000:288) states that 'these extrarole behaviours refer to discretionary employee actions which go beyond prescribed role expectations, and are not directly or explicitly recognized by the formal reward system'. Many follow Janssen (2000)'s definition of IWB, including Bos-Nehles et al. (2017), Sanz-Valle and Jiménez-Jiménez (2018), as well as Veenendaal (2015). When defining IWB, Kleysen and Street (2001) borrow from West and Farr (1989) and explain IWB as 'all individual actions directed at the generation, introduction and or application of beneficial novelty at any organisational level' (p. 285). They state that this novelty relates to new products, technologies and processes, aimed at significantly enhancing organisational efficiency and effectiveness. Lastly, when defining IWB, De Jong and Den Hartog (2010) reference the work of Janssen (2000), as well as Scott and Bruce (1994), and claim that IWB 'encompass(es) a broad set of behaviours related to the generation of ideas, creating support for them, and helping their implementation' (p. 23). They then present the definition of Farr and Ford (1990) to describe IWB as 'an individual's behaviour that aims to achieve the initiation and intentional introduction (within a work role, group or organization) of new and useful ideas, processes, products or procedures' (p. 24).

2.2. The structure of innovative work behaviour

The aforementioned definitions describe IWB in terms of an input–throughput–output model (Kast & Rosenzweig 1972), being deterministic (Teece 2018), directed to specific outcomes or even being path-dependant (Levy 1994). The specific outcomes are presented as positive and being beneficial to the organisation's success. Although all the authors share a multi-dimensional and multi-stage perspective of IWB, it will become clear from what follows that the authors differ in their understanding of the nature and number of dimensions IWB comprises.

Scott and Bruce (1994) propose IWB as a multi-stage process, consisting of distinct activities associated with each stage. The first stage involves creativity, where ideas or solutions, which may be novel or adopted, are generated. Following generation, sponsorship for the idea is necessary, and individuals try to build coalitions in order to further the idea. In

the last stage, the innovative individual completes the process by operationalising the idea. This process seems to follow from the work of Kanter (1988). Kanter proposes a four-stage process, involving idea generation, coalition building, idea realisation and transfer or diffusion. The last stage of 'spreading the model – the commercialisation of the product, the adoption of the idea' (Kanter 1988:512) seems to be incorporated in idea realisation, as proposed by Scott and Bruce (1994).

Scott and Bruce (1994), however, state – in contradiction to their presentation of a sequential list of activities – that innovation should for all intents and purposes be regarded as a set of discontinuous activities rather than discrete and sequential stages and that individuals may at any time be involved in any of these activities.

Janssen (2000) follows Scott and Bruce's (1994) conceptualisation of IWB and also explains it as a multifaceted behaviour consisting of three behavioural tasks, namely, idea generation, idea promotion and idea realisation. Janssen (2000) explains that innovation begins with idea generation, which is often instigated by perceived work-related problems, incongruities, discontinuities and emerging trends. Next, the idea needs to be endorsed by capable sponsors, so as to provide the necessary assistance for implementation.

The last element involves realisation, which includes experimentation, and ultimately the application of the idea. Janssen (2000) states that in the case of small innovations, one individual may be involved in all these activities, whilst more complex innovations usually require area-specific expertise. Janssen (2000) supports the notion that the innovation processes are often characterised by discontinuous activities and that 'individuals can be expected to be involved in any combination of these behaviors at any time', as proposed by Scott and Bruce (1994:582). The development work done by Janssen (2000) is widely acknowledged, including by Lukes and Stephan (2017).

Kleysen and Street (2001) confirm the idea that IWB is a multi-dimensional construct and, following an extensive literature, review five elements as essential in individual innovation, namely, opportunity exploration, generativity, information investigation, championing and application. Opportunity exploration involves the act of discovering or learning more about innovation opportunities. This involves paying attention to the environment and gathering information about possible opportunities, therefore looking for possibilities, and recognising innovation opportunities as such. Generativity relates to the

formulation of creative ideas that refer to beneficial changes and solutions to problems. However, it goes beyond pure creativity and also involves ideas being categorised, associations being drawn between ideas and ideas being combined in new ways. Information investigation is concerned with experimentation, thus giving form to specific innovation and trying out new ideas. This requires the accurate formulation of the concept, piloting it and also evaluating the outcome thereof. Championing involves the sociopolitical element of innovation. To mobilise the necessary resources and to implement the idea or solution, influencing and persuasion are necessary, as change normally involves the challenging of old ways as well as risk-taking.

Application forms the final and apex element of innovation behaviour and signifies the adoption of the innovation. This involves the implementation of the solution, reorganising or modifying present systems and ultimately a broad-based acceptance of the new direction. Kleysen and Street (2001) proposed a model in which each of the factors is related to each other – fundamentally based on their confidence in their literature review.

De Jong and Den Hartog (2010) stated that theoretically much work has been done to distinguish between various dimensions and different stages of the innovation process. They then presented a four-stage scheme of IWB, focussing on idea exploration, generation, championing and implementation. Idea exploration could be seen as the first step in the innovative process, where an individual identifies a problem or opportunity, with the urge to overcome the problem or make use of the opportunity. This step identifies problems or opportunities often related to the constant change in the environment, and may include issues related to current products, services or processes. Idea generation is the next proposed element of IWB. It relates to the idea of solving the identified problems or making use of the opportunities. It often involves the combination and reorganisation of information and concepts in different ways, therefore 'rearranging already existing pieces into a new whole' (De Jong & Den Hartog 2010:24). Idea championing is an essential element of innovation as most ideas need to be promoted because of resistance caused by the requirement to change existing ways of doing things, and by the unknown effect of the envisaged benefits of its implementation. Often it involves individuals finding support for creative ideas through their informal roles and building coalitions within the organisation. Idea implementation follows only after enough support and enthusiasm for the idea have been obtained. This implies

operationalising the idea, which requires putting sufficient effort into rolling out the idea and being results-oriented. It could include creating a culture of innovation and organisational learning. De Jong and Den Hartog (2010), however, are aware of the modelling of IWB as a multi-dimensional construct, and therefore tested two hypotheses in presenting their measure of IWB. They claimed that: (1) the four elements contribute to an overall construct (IWB) and (2) the four elements are distinct dimensions of IWB. In this paper, similar hypotheses will be tested.

The various aforementioned authors are in agreement as to the basic structure of IWB, although they differ on the exact number of stages through which IWB evolves. In many respects, this may be a matter of semantics, or at best a more refined look at the phenomena. In the discussion which follows, more details on the way the authors conceptualise the stage will become clear, as the items they include in their questionnaires reveal a significant part of their thinking.

2.3. Measuring innovative work behaviour

The way IWB is measured reflects the conceptualisation of the concept. Given below are four measures of IWB, stating the number of items included, the response format used, the items themselves, as well as some information on the reliability and validity of the instruments.

Scott and Bruce (1994) presented a six-item questionnaire, in which supervisors rated employees on a five-point Likert-type scale, ranging from 'not at all' to 'an exceptional degree'. The first item read as follows (Scott & Bruce 1994:606–607): '[s]earches out new technologies, processes, techniques and/or product ideas' [sic].

Although references to Scott and Bruce (1994) are very common, their scale of IWB is not often used. Lukes and Stephan (2017) used some of the items in developing their own questionnaire, whilst Lin and Lee (2017) used the questionnaire in an adapted form. Cronbach's alpha on this original scale was 0.89 (Scott & Bruce 1994). Lin and Lee (2017) reported an α-value of 0.86 on their adapted scale. With respect to validity, Scott and Bruce (1994) found a correlation of 0.33 ($p < 0.001$) between an objective measure of innovation, based on each respondent's innovative history, and supervisors' ratings of IWB. They suggest that this provides some assurances as to the validity scale. Furthermore, Lin and Lee (2017)

reported, using confirmatory factor analysis (CFA), that employees' innovative behaviour, organisational learning and work engagement scales each had standardised factor loading larger than 0.70, which they considered as evident of good convergent validity of each scale.

Janssen (2000) proposed nine items to measure IWB, which can be self-reports or ratings of employees by direct supervisors. Respondents were asked to indicate how often they (or in the case of supervisors, employees) could be associated with particular behaviours in the workplace. The response format was a seven-point scale ranging from 'never' (1) to 'always' (7). The item and the aspects they assess are presented by Janssen (2000). The first item read as follows: 'Creating new ideas for difficult issues (idea generation)' (p. 292). The first three items assessed idea generation, the next three assessed idea promotion, whereas the last three focussed on idea realisation.

Janssen's measure was recently used by Amir (2015), as well as by Javed et al. (2017). Janssen (2000) reported Cronbach's alphas of 0.95 for the self-rated and 0.96 for the leader-rated scores of IWB. Amir (2015) does not provide any reliability data, but Javed et al. (2017) reported an alpha of 0.70. Regarding validity, Janssen (2000) reported that the intercorrelations between the three aspects of IWB ranged from 0.84 (between idea generation and idea realisation) to 0.87 (between idea generation and idea promotion) for the leader-reports, and from 0.76 (between idea generation and idea realisation) to 0.85 (between idea promotion and idea realisation) for the self-reports. Given these high intercorrelations, and following Scott and Bruce (1994), idea generation, idea promotion and idea realisation were perceived to combine additively to create an overall scale of IWB.

Amir (2015) replicated the proposed structure of Janssen (2000), reporting that a three-dimensional model showed a better fit than two-dimensional and single models.

Kleysen and Street (2001)'s questionnaire comprises 14 items. Respondents were asked to rate themselves with regard to each statement on a six-point scale, varying from 'never' (1) to 'always' (6). All the questions had the same prefix, namely, 'In your current job, how often do you'. The first item's individual questions read as follows (Kleysen & Street 2001:293): ' … look for opportunities to improve an existing process, technology, product, service or work relationship?' The first three items were related to exploration. Items 4 and 5 referred to generativity, with the consecutive items, in groups of three, relating to information investigation, championing and application.

Kleysen and Street (2001) reported a reliability coefficient higher than 0.70 for all the sub-scales, which is acceptable (Hair et al. 2010). The alpha for opportunity exploration was 0.71. For generativity, it was the same (0.71) and for information investigation it was 0.802. In the case of championing, the alpha was 0.89, and for application it was 0.79. Hebenstreit (2003) reported an alpha of 0.94, when using all the items. Lu and Li (2010) found a two-factor solution, and reported the Cronbach's alpha values as 0.86 for each of these factors. Wojtczuk-Turek and Turek (2013) also reported on a two-factor solution, with values of 0.88 and 0.89 respectively. The results of the confirmatory factor analysis performed by Kleysen and Street (2001) did not lend empirical support to the theorised structure. However, these authors argued that as the items were developed to represent a well-defined domain, this provided construct validity to the measure. Although Kleysen and Street (2001) suggested the use of the items as a single measure of innovation behaviour, they also stated that their research demonstrates the multi-dimensionality of the construct. Hebenstreit (2003), following this stance, reported on a single factor. Lu and Li (2010), on the other hand, reported two factors (innovative idea generation and innovative idea implementation), as do Wojtczuk-Turek and Turek (2013), who refer to these factors as: (1) recognising problems and initiating activities, as well as (2) generating ideas and implementing them.

De Jong and Den Hartog (2010) stated that the aim of their questionnaire was to capture the multi-dimensional measures of individual innovative behaviour, as such an instrument was not available at the time, and owing to the fact that the construct is theoretically treated as multi-dimensional. The questionnaire contained 10 items, to be completed by supervisors. The responses ranged from 'never' (0) to 'always' (6). All the items have the same prefix, namely, 'How often does this employee …'. The first question reads as follows (De Jong & Den Hartog 2010:29): ' ... pay attention to issues that are not part of your daily work?' Idea exploration (Item 1 and 2), generation (Items 3, 4 and 5), championing (Items 6 and 7) and implementation (Items 8, 9 10) were the dimensions assessed by the questionnaire.

The De Jong and Den Hartog (2010) instrument is used by De Spiegelaere et al. (2014), Niesen et al. (2018), as well as by Polston-Murdoch (2015). Veenendaal (2015) adopted items from De Jong and Den Hartog (2010) and Kleysen and Street (2001) when they developed their own measure. De Jong and Den Hartog (2010) reported a Cronbach's alpha coefficient

of 0.90 for idea exploration, 0.88 for idea generation, 0.95 for idea championing and 0.93 for idea implementation. These coefficients are consistently high and acceptable (Hair et al. 2010). Atitumpong and Badir (2017) reported an alpha of 0.88, when using all the items. Reporting on two dimensions, De Spiegelaere et al. (2014) reported alphas of 0.91 and 0.93, respectively. Similarly, Niesen et al. (2018) reported on two factors, with values of 0.87 and 0.90, respectively, with 0.87 when using all the items.

Applying confirmatory factor analysis as well as simple correlation analysis, De Jong and Den Hartog (2010) concluded that the four elements contributed to an overall construct of IWB, rather than being four distinct dimensions of IWB. Atitumpong and Badir (2017) reported on a single factor, whilst De Spiegelaere et al. (2014) identified two factors, which they named idea generation and idea implementation. Niesen et al. (2018) also reported on two factors, which they call idea generation and idea implementation. Furthermore, De Jong and Den Hartog (2010) tested three hypotheses relating to the criterion validity of the instrument, all of which were supported. Most importantly, scores on the IWB Scale correlated positively with innovative outcomes.

From the aforementioned, some differences amongst the authors regarding the stage-type conceptualisation of IWB is visible. Although Scott and Bruce (1994) presented their measure as a single scale (six items), the items seem sequential. The others present items linked to dimensions, which also appear sequential. The authors agree on the perceived multi-dimensional nature of IWB but disagree on the number of these dimensions. Also, researchers attempt to replicate these theorisations empirically applying factor analyses, often resulting in them resurging back to simpler or single models, based on their empirical findings. There seems to be a dissonance between the theory and the empirical evidence, which is (inadequately) ascribed to IWB comprising discontinued activities and individuals being involved in several of these activities simultaneously – as originally suggested by Scott and Bruce (1994). These inadequate explanations suggest a theoretical flaw in the understanding of the structure of IWB. Bos-Nehles et al. (2017:1229) echoed this and stated that ‘ … knowledge about IWB … is fragmented and inconsistent’ and ‘as such, organisations may be restricted in their ability to innovate … because they do not know how to trigger employees in a way that will encourage them to engage in IWB’.

The aim of the study was to achieve more clarity on the conceptualisation of IWB through testing different measurement models to reveal which data-driven model best explains the phenomena. Using increasingly advanced modelling techniques may reveal the precise structure of IWB.

3. Method

3.1. Population and sampling

The target population consisted of all employees and all organisations. However, availability, accessibility, proximity and cost necessitated a focus on South African organisations. Only medium to large organisations were targeted. To gain access to these organisations, Master of Business Leadership students were recruited to gain permission to conduct research in these medium to large organisations. In most cases, access to organisations was granted to the students based on their relationships with specific organisations. In most cases, they were employed by these companies. The sampling of corporate entities was therefore based on convenience.

The students were required to draw a random sample of employee lists in the organisations to which they received access. Each student was requested to deliver 60 completed questionnaires. To achieve this, they started off by drawing a sample of 60 and then, depending on the response rate, drew fresh samples from the original list until they reached the target of 60. Although the sampling process was not perfect, it inclined towards a random sample.

3.2. Measurement instrument

Kleysen and Street (2001)'s 14 item IWB questionnaire, discussed above, was used. As stated above, respondents were asked to rate themselves with regard to the 14 statements on a six-point scale, ranging from 'never' (1) to 'always' (6). The first three items measured exploration, with items 4 and 5 measuring generativity. The information investigation,

championing and application was each measured with three items. Historic reliability and validity information, as provided above, were at an acceptable level.

3.3. Participants

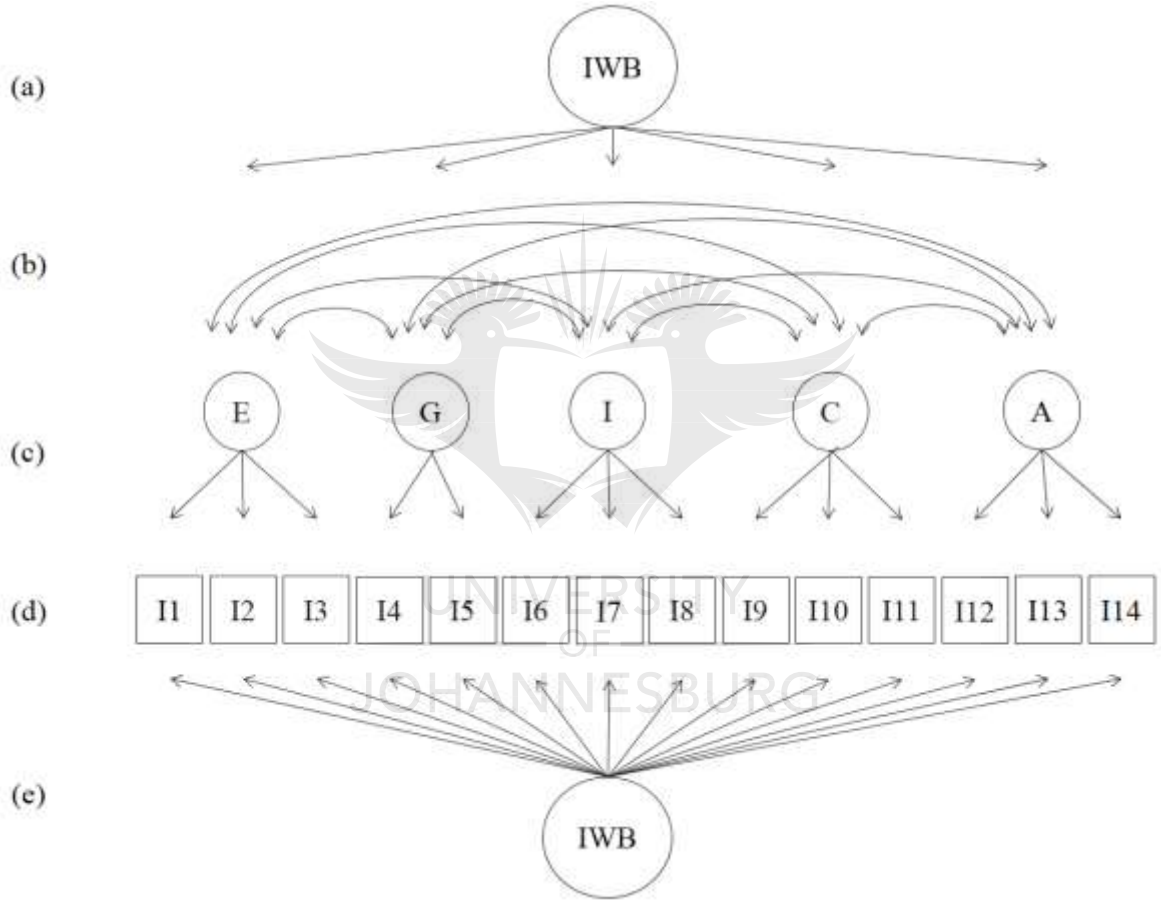
In total, data were collected from 3180 respondents. After removing cases with missing data, as well as data sets with out-of-range data, 3 096 cases remained. Participants represented the following race groups: Asian 8.4%, black 58.1%, mixed ethnicity 8.4% and white 25.1%. The mean age for the group was 37.81 years, with a standard deviation of 9.10. In terms of schooling, 4.5% reported 'Less than 12 years schooling', 25.1% reported '12 years of schooling', 40.5% reported '1st Degree/Diploma' and 29.7% reported 'Higher Degree/Higher Diploma'. With regard to tenure, the mean tenure was 8.46 years, with a standard deviation of 7.45 years. In total, 36.3% of respondents reported that they held a managerial position. When reporting on being involved in the core business of the organisation, versus support services, 45.2% of respondents reported that they were involved in the core business of their companies.

3.4. Analysis

The analyses were performed in IBM SPSS Statistics (IBM SPSS Statistics 2017) and with the lavaan package (Rosseel 2012) in R (R Core Team 2013). Demographic data were generated first so as to define the sample. This was followed by descriptive data on the 14 items, including skewness and kurtosis. This was done to assess if the data did not diverge significantly from normality. The data did not diverge significantly.

Cronbach's alpha coefficients for the IWB were then calculated. This value, reported later, was deemed acceptable (>0.90), which allowed for the analysis of the suitability of the data for factor analyses. Kaiser–Meyer–Olkin's measure of sampling adequacy (KMO) and Bartlett's test of sphericity were performed and the results were acceptable, with KMO being excellent (>0.90 – [Field 2009]) and the Bartlett's test value being significant, and therefore acceptable (Pallant 2013). This allowed for the performance of exploratory factor analyses (EFA). Given outputs of the EFA, and particularly the strong one-factor solution suggested by

the difference between the first and the second eigenvalue, the correlation between the factors of the EFA was calculated, as well as the Schmid–Leiman transformed solution, which reflects the direct relationships between the items with the general factor and the residualised group factors (Schmid & Leiman 1957). Aforementioned did not provide comprehensive or conclusive results pertaining to the factorial structure of the IWB questionnaire; therefore, confirmatory factor analyses (CFI) were performed wherein five different fit models were tested. Figure 1 graphically presents the different models tested.



Source: Authors' own work.
FIGURE 1: Measurement models for the innovative work behaviour. IWB, innovative work behaviour; E, exploration; G, generativity; I, information investigation; C, championing; A, application. I1 through I14, the items of the innovative work behaviour questionnaire.

In Figure 1, combining (d) and (c) denotes a five-factor orthogonal model. Linking (d), (c) and (b) represents a correlated five-factor model. Joining (d), (c) and (a) represents a

higher-order five-factor model. When adding (d) and (e), a single-factor model is presented and with (d), (c) and (e) a combined bi-factor model is attained.

As the χ^2 statistic is no longer relied upon as a basis for the acceptance or rejection of model fit (Schermelleh-Engel, Moosbrugger & Müller 2003; Vandenberg 2006), it was not reported. Six measures of fit were reported on, namely, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Root Mean Square Error of Approximation (RMSEA) and Standardised Root Mean Square Residual (SRMR). Comparative Fit Index and TLI values greater than 0.95 were used as being indicative of a good model fit (Vandenberg & Lance 2000). No specific cut-off values for AIC or BIC were specified and the rule of thumb was rather used, which states that the model with the lowest AIC or BIC value is the better fitting model (Schreiber et al. 2006; Van de Schoot, Lugtig & Hox 2012). Some suggest cut-off value for RMSEA < 0.08 (Van de Schoot et al. 2012), others RMSEA < 0.06 (Schreiber et al. 2006) whilst Awang (2012) and Hair et al. (2010) suggest that the model fit is acceptable when RMSEA < 0.05. In this research, the more generous cut-off value for RMSEA < 0.08 (Van de Schoot et al. 2012) was used. This fits in well with SRMR < 0.08 seen as indicative of acceptable model fit, as suggested by Browne and Cudeck (1993).

4. Results

4.1. Descriptive statistics

The following are descriptive statistics of the scores on the individual IWB items, as well as the total scores.

Table 1

Descriptive statistics

Item	Mean	Standard Deviation	Skewness	Kurtosis	Standard Error
Item 1	4.09	1.22	-0.10	-0.66	0.02
Item 2	4.12	1.17	-0.15	-0.47	0.02
Item 3	3.76	1.16	0.03	-0.29	0.02
Item 4	4.01	1.16	-0.04	-0.47	0.02
Item 5	3.97	1.17	-0.12	-0.36	0.02
Item 6	3.78	1.18	0.07	-0.45	0.02
Item 7	3.63	1.20	0.15	-0.38	0.02
Item 8	3.66	1.22	0.08	-0.39	0.02
Item 8	3.74	1.24	0.02	-0.49	0.02
Item 10	3.65	1.26	0.05	-0.56	0.02
Item 11	3.63	1.23	0.03	-0.49	0.02
Item 12	3.75	1.24	-0.01	-0.48	0.02
Item 13	3.62	1.20	0.08	-0.32	0.02
Item 14	3.68	1.22	0.05	-0.39	0.02
Total score	52.98	13.17	0.08	-0.22	0.23

Source: Authors' own work.

From Table 1, it can be observed that the mean scores for Exploration (Items 1, 2, and 3) and Generativity (Items 4 and 5) were visibly higher than in the case of the other constructs. This may be interpreted as some ideas just remaining ideas and not resulting in innovation. This aspect will be addressed in more detail in the Discussion section. The skewness and kurtosis data indicate that the distribution of the data does not diverge from normality.

4.2. Exploratory factor analysis

The Kaiser–Meyer–Olkin measure of sampling adequacy was acceptable at 0.961 and Bartlett's test of sphericity yielded significant results ($p < 0.001$), which suggested that the data were factorable. Exploratory factor analysis was performed to test for the presence of a five-factor solution, as proposed by some literature. The results of the pattern matrix are presented below, where all items with a loading higher than 0.30 are bolded. Five factors accounted for 80.04% of the variance in the data.

Table 2

Exploratory factor analysis

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Commonalities
Item 1	0.03	0.00	**0.74**	0.03	0.04	1.0
Item 2	0.00	0.01	**0.92**	-0.02	-0.02	1.0
Item 3	0.02	-0.03	**0.33**	0.23	0.15	2.3
Item 4	0.02	-0.01	0.00	**0.92**	0.00	1.0
Item 5	-0.02	0.22	0.12	**0.45**	0.10	1.8
Item 6	0.00	**0.71**	0.09	0.09	-0.02	1.1
Item 7	-0.01	**0.88**	0.00	-0.02	0.00	1.0
Item 8	0.16	**0.58**	-0.04	0.04	0.13	1.3
Item 8	**0.51**	0.21	0.03	0.10	0.04	1.4
Item 10	**0.88**	-0.01	0.04	0.04	-0.05	1.0
Item 11	**0.70**	0.02	0.03	-0.02	0.11	1.1
Item 12	**0.41**	0.10	0.04	0.01	**0.31**	2.0
Item 13	-0.01	0.01	0.02	0.03	**0.84**	1.0
Item 14	0.21	0.11	0.08	0.03	**0.49**	1.5

Source: Authors' own work.

Note: Significant loadings, higher than 0.3, are bolded to enable easy interpretation.

From Table 2, it is evident that the structure created through EFA resembles the theorised structure well. Apart from item 12, all the items loaded on separate factors, clustering with the items that measure the same sub-construct. For the five-factor solution RMSR = 0.01, TLI = 0.98 and RMSEA = 0.048 (90% CI: 0.042–0.053) indicated good fit of a five-factor model. The BIC = -0.86.

However, the eigenvalues of the factors (8.59, 0.90, 0.64, 0.57 and 0.56) suggested a very strong general factor. To explore this possibility, the correlations between the factor loadings were calculated.

Table 3

Correlation among extracted factors

Factor	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1.00	0.82	0.69	0.68	0.77
Factor 2	0.82	1.00	0.72	0.74	0.72
Factor 3	0.69	0.72	1.00	0.73	0.62
Factor 4	0.68	0.74	0.73	1.00	0.62
Factor 5	0.77	0.72	0.62	0.62	1.00

Source: Authors' own work.

The range of the correlations was between 0.62 and 0.82, which is relatively high (see Hair et al. 2010). This prompted testing for the extent to which a higher factor may explain the variance in the data. A Schmid–Leiman transformed solution (Schmid & Leiman 1957), which transforms a higher-order factor solution into an orthogonal hierarchical solution with a general factor and residualised group factors was obtained. This solution reflects the direct relationships of the items with the general factor and the residualised group factors.

Table 4

Schmid-Leiman solution

Item	General factor	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Item 1	0.68		0.44			
Item 2	0.72		0.55			
Item 3	0.56		0.20			
Item 4	0.76					0.54
Item 5	0.72					0.26
Item 6	0.78			0.30		
Item 7	0.78			0.37		
Item 8	0.79			0.24		
Item 8	0.78	0.23				
Item 10	0.80	0.40				
Item 11	0.74	0.31				
Item 12	0.76					
Item 13	0.72				0.51	
Item 14	0.77				0.29	
Eigenvalues	7.71	0.36	0.54	0.30	0.40	0.38

Source: Authors' own work.

The general factor accounted for 80% of the common variance among the 14 items (explained common variance = 0.80). This may be indicative that the general factor saturated the total score significantly. Against this background, a general factor model was tested, to assess the adequacy of just a general factor and no group factors. This yielded the following fit statistics: RMSR = 0.06, BIC = 2 354.59 and RMSEA index = 0.11 (90% CI 0.107–0.114). As a whole, these results indicate that a general factor model does not adequately account for the covariances of the 14 items.

4.3. Confirmatory factor analysis

Confirmatory factor analyses were performed, focussing on variations of the five-factor solution. Five models were tested to assess which theoretical structure fitted the data best. Firstly, a five-factor model with correlated factors was tested (see Figure 1; d + c + b). Next, a higher-order model was tested, specifying that the five factors load on a single higher-order factor (see Figure 1; d + c + a). An orthogonal five-factor model was then tested (see Figure 1; d + c). After that, a bi-factor model was tested – implying that the data could be explained by a single general factor and five residualised group factors (see Figure 1; d + c + e). Lastly, a single factor solution was tested (see Figure 1; d + e). In Table 5, the item loadings related to the different models are presented. The factor loadings for each of the models are presented in Table 5.

Table 5

Loading of the different items per model

Latent variable / Item	Factor loading – five-factor model	Factor loading – higher order model	Factor loading – orthogonal model	Factor loading – bi-factor model	Factor loading – single factor model
Exploration items					
Item 1	0.828	0.827	0.820	0.439	
Item 2	0.858	0.860	0.884	0.551	
Item 3	0.627	0.621	0.590	0.213	
Generativity items					
Item 4	0.839	0.837	0.835	0.372	
Item 5	0.822	0.824	0.826	0.367	
Investigation items					
Item 6	0.833	0.832	0.827	0.214	
Item 7	0.840	0.841	0.873	0.500	
Item 8	0.840	0.841	0.813	0.156	
Championing items					
Item 8	0.840	0.844	0.891	0.167	
Item 10	0.870	0.870	0.896	0.423	
Item 11	0.805	0.800	0.798	0.219	
Application items					
Item 12	0.825	0.822	0.789	0.174	
Item 13	0.792	0.794	0.817	0.391	
Item 14	0.849	0.851	0.863	0.318	
Innovation components					
Exploration		0.837			
Generativity		0.869			
Investigation		0.947			
Championing		0.949			
Application		0.938			
All innovation items					
Item 1				0.683	0.698
Item 2				0.708	0.721
Item 3				0.572	0.581
Item 4				0.749	0.755
Item 5				0.739	0.744
Item 6				0.789	0.796
Item 7				0.780	0.794
Item 8				0.810	0.813
Item 8				0.811	0.815
Item 10				0.818	0.827
Item 11				0.760	0.769
Item 12				0.788	0.792
Item 13				0.731	0.745
Item 14				0.793	0.802

Table 6 complements Figure 1 in explaining the different fit models as well as the items and residualised group factors included in the analyses. From Table 6, it can be observed that loadings were consistently high in all models, except for the bi-factor model, where the loadings on the general factor were high, but the loadings on the five group factors were consistently less salient. To test which of the theoretical structures fitted the data best, several fit statistics were calculated. These are presented below.

Table 6

Fit statistics

Statistic	Five-factor model	Higher order model	Orthogonal model	Bi-factor model	Single factor model
CFI	0.982	0.975	0.609	0.982	0.916
TLI	0.975	0.969	0.544	0.975	0.901
AIC	107 821.6	108 031.1	119 681.5	107 813.7	109 912.8
BIC	108 135.5	108 314.9	119 929.0	108 139.7	110 166.4
RMSEA	0.053	0.060	0.227	0.053	0.106
RMSEA 90%CI	0.048-0.58	0.055-0.065	0.223-0.321	0.048-0.059	0.101-0.111
SRMR	0.021	0.028	0.461	0.022	0.040

Source: Authors' own work.

CFI, confirmatory factor analyses; TLI, Tucker-Lewis Index; AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; RMSEA, Root Mean Square Error of Approximation; RMSEA 90%CI, RAMSEA 90 per cent confidence interval; SRMR, Standardised Root Mean Square Residual.

In Table 6, it can be observed that the orthogonal model, given CFI, TLI, RMSEA and SRMR, did not meet the requirement for acceptable fit. All the other models met the basic requirements of satisfactory fit. From the results in Table 6, it can be seen that the correlated five-factor model and the bi-factor model competed well for the best fit, outperforming the higher-order and the single-factor models substantively. For the five-factor model and the bi-factor model, most of the statistics are identical, with AIC lower (better) in the bi-factor model and BIC lower (better) in the five-factor model. Standardised Root Mean Square Residual was also lower for the five-factor model, which suggests better fit. The five-factor model was adopted as the best representation of the present data, as more parameters indicated that the fit is best, but also as it represents a simpler model, which is mostly desirable.

5. Discussion

Having a clear understanding of what IWB entails is important as it relates to important organisational outcomes (Bos-Nehles et al. 2017; Sanz-Valle & Jiménez-Jiménez 2018; Veenendaal 2015). Although most researchers interested in IWB conceptualise and measure IWB as a multistage process (De Jong & Den Hartog 2010; Farr & Ford 1990; Janssen 2000; Kanter 1988; Kleysen & Street 2001; Scott & Bruce 1994; West & Farr 1989), they experience difficulty in trying to emulate these stages when applying factor analyses. Referring Kleysen and Street's (2001) measure of IWB, neither these authors nor Hebenstreit (2003), Lu and Li (2010) or Wojtczuk-Turek and Turek (2013) could replicate the structure, reporting simpler models with less factors. With regard to the De Jong and Den Hartog (2010) instrument, the same problems were experienced (see Atitumpong and Badir [2017], De Spiegelaere et al. [2014] and Niesen et al. [2018]). Scott and Bruce (1994)'s explanation for realising less factors when testing measurement models of IWB, supported by De Jong and Den Hartog (2010), Janssen (2000), and Scott and Bruce (1994), is still unsubstantiated. The present study was therefore necessary, in order to shine some light on the matter, using more complex models to unravel relationships between the different elements of IWB.

In the present study, a large group of respondents (3 096 employees), comprising both men and women, representative of the ethnic diversity of the South African workforce when considering Statistics South Africa requirements, completed the questionnaire. The collected data on the IWB questionnaire (Kleysen & Street 2001) did not deviate meaningfully from the normal distribution and the Cronbach's alpha of 0.95 indicate high reliability.

An interesting fact emerges from the descriptive statistics, namely, that the scores for the first two constructs (Exploration and Generativity) are considerably higher than the scores for the following constructs (Information investigation, Championing and Application). This may suggest that more employees explore and generate ideas than those who make an effort to implement them. This intuitively makes sense, as it takes much more effort to implement an idea rather than coming up with one. This could also be a managerial concern, where management does not enable employees to voice or implement their ideas.

The EFA revealed a factorial structure in line with the structure suggested by Kleysen and Street (2001), with the exception of Item 12, which loaded on both Championing and

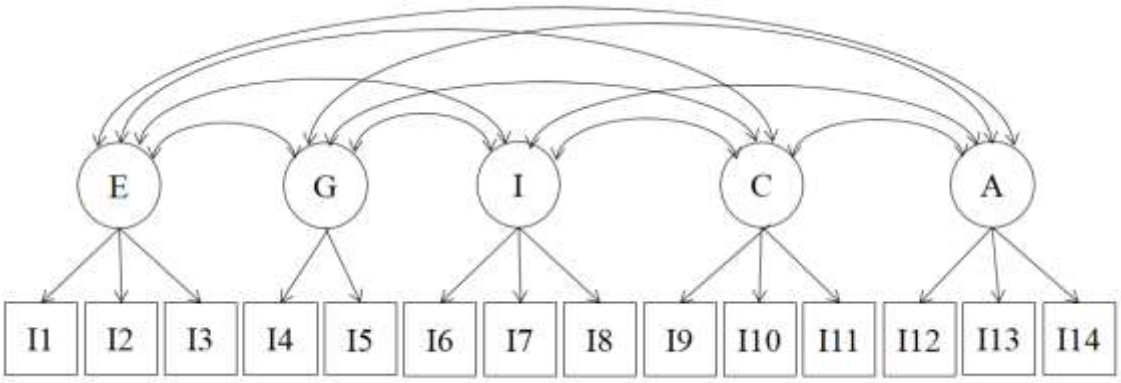
Application (see Table 2).

Item 12 refers to '… implement(ing) changes that seem to be beneficial?' (Kleysen & Street 2001:293). It could be that respondents interpreted this statement from a managerial perspective as championing, rather than from an operational perspective, as application, particularly as 36.3% of respondents reported that they held some managerial position. Despite the double loading of Item 12, all the other items loaded in accordance with their theorised function.

The strong correlation between the factors extracted through EFA (see Table 3), the eigenvalues pointing to a single general construct and the reporting of a single construct by Hebenstreit (2003) necessitated testing for a general construct model. The Schmid–Leiman transformation was performed (see Table 4), with the general factor accounting for 80% of the common variance among the 14 items. The fit statistics revealed that the general factor model does not adequately account for the covariances among the items.

Using the lavaan package (Rosseel 2012) in R (R Core Team 2013), five competing factorial models were tested (see Table 5). The fit of the orthogonal model, suggesting that the factors are independent and unrelated, was very poor, which supports the theory that the elements of IWB are indeed related, given *argumentum ad ignorantiam*. However, four subsequent models in which the items and/or factors are related were tested. The weakest of these, by far, was the single factor solution, which was therefore excluded as a candidate for ideal fit. This finding is contrary to the findings of Kleysen and Street (2001) and Hebenstreit (2003), who theorised about the existence of separate factors, but who could statistically find only a single factor.

After considering the remaining models (the higher-order five-factor, the bi-factor models and the correlated five-factor model), the bi-factor models and the correlated five-factor model yielded almost equal results. The correlated five-factor model was accepted as the best fitting model, given the fit statistics being the best for most parameters. Also, in the competing bi-factor model, many items did not have significant loadings (see Table 6), while consistent high loadings were reported in the same table for the correlated five-factor model. Furthermore, simpler models are desirable, particularly where application is concerned (Aguilar-Savén 2004). Best fitting factorial structure for the IWB is presented below.



Source: Authors' own work.
FIGURE 2: Correlated five-factor model for the innovative work behaviour. E, Exploration; G, Generativity; I, Information investigation; C, Championing; A, Application. I1 through I14 are items of the innovative work behaviour questionnaire.

6. Conclusion

A correlated five-factor model explains the measurement fit of IWB as proposed by Kleysen and Street (2001) and appears to be superior to all other factorial models. This suggests that IWB indeed comprises separate but dependent sub-constructs. It has implications for those interested in enhancing IWB, as it could be possible to focus on specific aspects of the phenomena so as to foster its development as a whole. It also shows the relatedness of the different sub-constructs, echoing Scott and Bruce (1994)'s notion that individuals performing IWB are involved in several of these activities simultaneously. This also has interventional implications, as fostering IWB should then not involve interventions at any specific part or at the start of the process (e.g. Exploration and Generativity), but also intervention at later stages of the process (e.g. Information Investigation, Championing, and Application), as they are all related. This makes sense if it is argued that an employee who has knowledge regarding how to implement ideas would also be more keen to generate them. Interventions at both these levels should thus be considered. Future researchers are encouraged to use IWB, as proposed by Kleysen and Street (2001), in their research as a five-factor correlated construct, as originally proposed by these authors.

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CHAPTER 5: GENDER-BASED DIFFERENCES IN THE MANNER INDIVIDUAL AND ORGANISATIONAL CONSTRUCTS ARE MEASURED: A TEST OF MEASUREMENT INVARIANCE

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Article 4: Gender-based differences in the manner individual and organisational constructs are measured: A test of measurement invariance

Abstract

Orientation: Practitioners and researchers often assume that the psychometric instruments they use are invariant and that they therefore measure similar constructs in a comparable manner across men and women respondents. This assumption is, however, rarely tested, leading to an undetected bias in research findings or an adverse impact due to the presence of non-invariance. Research purpose: After presenting the basics about measurement invariance (MI) and arguing for the testing thereof, this research aims to demonstrate the prevalence of MI across several frequently used psychometric instruments often used based on the assumption that measure equivalent constructs across gender. Motivation for the study: Firstly, this study aims to increase awareness regarding MI, a property that can easily be tested. Secondly, the research aims to identify instruments which could be used in conducting investigations that attempt to understand gender matters in the workplace. Design and method: Cross-sectional survey data, pertaining to seven standard instruments, all related to innovative work behaviour, were analysed. Pairwise multigroup confirmatory factor analyses with robust maximum likelihood estimation was used to examine configural, metric, intercept and strict invariance, as well as, the equivalence of the latent means. Main findings: The findings were binary, with four of the instruments showing MI at an equal latent means level, whilst three instruments were non-invariant at the configural level. MI was either accepted completely, or rejected completely. Practical implications: The serratedness of findings, even when using well-recognised and frequently used psychometric instruments, exposes the prevalence of non-invariance in some instruments, therefore necessitating the standard testing for MI. The findings also specify the instruments which are MI (in terms of gender), which allow other researchers and practitioners to use these instruments with more confidence when comparing men and women respondents in their studies. Contribution: This research demonstrates the ease with which MI testing can be performed and alert researchers to do MI testing when conducting cross group studies, as the prevalence of measurement non-invariance is high.

Key words: Gender, measurement invariance, bias, adverse effect, group differences, innovative work behaviour.

Introduction

Gender is a prominent variable within the organisational setting, demonstrated by journals such as “Gender, Work, and Organisations” (Wiley), “Gender in Management: An International Journal” (Emerald Publishing), “International Journal of Gender and Entrepreneurship” (Emerald Insight), and “Gender and Behaviour” (Sabinet). These publications all focus on gender as a salient variable in the workplace. In many studies the

perceptions of men and women are compared, or measures of perceptions are used in models to test hypotheses related to gender differences (Eagly, 1997; Eagly & Wood, 1999). Differential outcomes based on gender are often reported (Eagly & Karau, 2002). Often these differential outcomes are explained from a sociological perspective, where differences are attributed to gender-specific roles, attributions, stereotypical expectations, performance or attitudes (Hatlevik, Scherer, & Christophersen, 2017). In many of these studies the assumption is made that measures of perceptions are accurate and equally valid for men and women. Examples of such "naïve" studies are plentiful (Eagly, Johannesen-Schmidt, & Van Engen, 2003; Selvarajan, Slattery, & Stringer, 2015; Tabvuma, Georgellis, & Lang, 2015; Wang & Gorenstein, 2015; Yi, Ribbens, Fu, & Cheng, 2015). In all of the aforementioned studies it is assumed that measures of perceptions are not gender-specific. Stated more correctly, in none of these studies the authors tested for the possibility that the measurements characteristics might differ depending on gender.

When considering differences between groups (for example men and women), it could be meaningful to go beyond the sociological explanations (Hatlevik et al., 2017), and (firstly) to question the assumption that individual test items and/or the entire scale operate equally across the groups (Millsap, 2011; Tsaousis & Kazi, 2013; Vandenberg & Lance, 2000). The concern, as raised above, is that this assumption is hardly ever tested explicitly and, according to Tsaousis and Kazi (2013), this renders all such comparative studies' findings highly questionable. Do different groups of respondents interpret a given measure in a conceptually similar manner? Stated more operationally, are the relationships between manifest indicator variables (scale items, subscales) and the underlying construct the same across groups (Bialosiewicz, Murphy, & Berry, 2013)? Should the construct not be measured equivalently, it will cause bias in the inferences drawn and therefore threaten the validity of the comparisons made (Hatlevik et al., 2017). These potential deviations from equivalence are referred to as measurement non-invariance (Holland & Wainer, 1993). To rule out the possibility that variations in the functioning of a scale result in biased interpretations of results, testing for measurement invariance (MI) is necessary (Hatlevik et al., 2017).

The academic community is certainly not naïve with regard to the possibility of gender-based MI, and some studies do include tests of MI (Kuhn & Holling, 2009; Van Zyl, 2016; Zampetakis, Bakatsaki, Litos, Kafetsios, & Moustakis, 2017). This is a relatively new

trend, however, with most studies failing to test for MI across groups of interest prior to making comparisons (Tsaousis & Kazi, 2013). This paper aims to contribute to the literature and the practice of gender-based research through critically analysing the present-day call for the testing of (gender-based) measuring invariance in studies where group (gender) differences are investigated. This will firstly be done by discussing MI, the levels of analyses, as well as the analyses themselves. The most significant contribution of this paper lies in the testing of MI across several scales, using the same set of respondents. Presenting tests of MI across several scales, using a common pool of respondents, is envisaged to present rich information on the prevalence, as well as extent of MI in these scales, which all measure elements within the organisational behaviour domain. The findings of this research allow for a critical analysis of broad statements which declare that "investigating measurement invariance should now become a routine part of research into the structure of group differences" (Borsboom, 2006, p. 176).

Literature review

Essential to psychometric assessment is that decisions will follow from the scores created, where individuals are categorised based on cut-off scores and afforded or denied opportunities based on this categorisation (Cohen, Swerdlik, & Sturman, 2013; Gregory, 2011). It is, however, possible that the administration or the nature of a measurement results in scores which systematically prevent accurate or impartial decisions (Cohen et al., 2013), excluding specific groups of individuals. When a score is not based on the individuals' standing on the construct, but rather on the individuals' group membership, the measurement is considered to be biased (Berry, 2015; Fontaine, 2008).

Group differences, bias and measurement invariance

An absence of measurement bias against distinct groups is a prerequisite for the use of a given measure in research or workplace assessment (Lee, Lee, Wells, & Sireci, 2016). The Constitution of the Republic of South Africa (Act 106 of 1996), and particularly the Bill of Rights, as well as the Employment Equity Act (Act 55 of 1998), promote equity, equal

opportunity and fair treatment, specifically referring to the fact that "psychometric testing and other similar assessments of an employee are prohibited unless the test or assessment being used has been scientifically shown to be valid and reliable, can be applied fairly to all employees, is not biased against any employee" (p. 2).

Differences in psychometric test results between groups (men and women) may be the results of substantive differences between the groups, or they may stem from bias measurements (Berry et al., 2011). Three types of bias which may result in differences between groups are commonly identified, namely construct, method, and item bias.

- Construct bias may exist when a measured construct is specific to a particular group, or when items related to the construct are underrepresented in the instrument for one group and where identical indicators (items) cannot be used across groups as the repertoire of behaviour associated with the construct differs substantively (Fontaine, 2008; Harzing, 2006).
- Method bias relates to variation in the scores which result from inadequacy in the instructions of the instrument, response styles that elicits specific responding in one group (e.g. more acquiescent responding), or group characteristics which differ along group lines on how to respond to the instrument (e.g. motivation to respond in line with a specific stereotype) (Fontaine, 2008; Libbrecht, Beuckelaer, Lievens, & Rockstuhl, 2014).
- Item bias, of particular interest in this article, materialises when an item systematically has a higher or lower score than expected in a specific group, given other indicators of the construct (Fontaine, 2008). Stated differently, the scores of two persons may differ, not in terms of their standing on the latent construct, but rather depending on their group status (Berry, 2015; Fontaine, 2008).

Detecting group differences based on construct heterogeneity (when the construct is not defined or when it measures in the same manner (Casper, Vaziri, Wayne, DeHauw, & Greenhaus, 2017; Van Zyl, 2016)), as well as measurement bias, can be addressed through testing for MI. MI is concerned with identifying items/instruments to which individuals respond in a similar manner, and asking whether respondents from different groups interpret a given measure in a conceptually similar manner (Vandenberg & Lance, 2000).

Observed mean score comparisons are based on the assumption of invariant or equivalent measurement across groups (Vandenberg & Lance, 2000). Although rarely tested (Tsaousis & Kazi, 2013), these assumptions are routinely and straightforwardly testable as extensions to the basic confirmatory factor analysis (CFA) framework. If not tested, violations of measurement equivalence assumptions threaten substantive interpretations of the results and equate to an inability to demonstrate reliability and validity (Bialosiewicz et al., 2013; Vandenberg & Lance, 2000).

It is the task of the researcher to ensure that the interpretation of the data is not distorted because of inequivalence (Berry et al., 2011). Having determined MI, researchers can compare the occurrence, antecedents and consequences of the latent factor scores across groups (Van de Schoot, Lugtig, & Hox, 2012). Testing for MI has important implications when decisions about individuals in a diverse workplace are to be made (Borsboom, 2006; Cheung & Rensvold, 2002). The meaningful interpretations of test scores across groups (nations, ethnic groups, age and gender) do not only serve organisational goals, but also serve to safeguard against the possibility of bias or a so-called adverse impact due to non-invariance (Van Zyl, 2016; Whitman, Van Rooy, Viswesvaran, & Kraus, 2009).

Measurement invariance assessment

The existing literature on MI is abundant (Van de Schoot, Schmidt, & De Beuckelaer, 2015). However, despite Vandenberg and Lance's (2000) seminal work, in which the authors review and synthesise MI literature, the terminology and practices are still not aligned and some confusion in the meaning of terms and uniformity in practices prevails. Presented below is an attempt to integrate some of the MI literature.

Testing for MI usually occurs within the CFA framework (Vandenberg & Lance, 2000) and the process of assessing MI essentially involves the testing of a series of increasingly restrictive equality constraints hypotheses (Bialosiewicz et al., 2013). It makes sense to discuss the levels of MI within the context of increasingly restrictive models:

- *Conceptual equivalence* (functional equivalence, construct bias) refers to a situation where the domain or trait makes sense in all the groups that are compared (Berry et al., 2011). When a measured construct is specific to a particular group, it would

therefore be impossible to find a comparable operational pattern of relationships with other constructs, across the groups (Fontaine, 2008). Although no statistical tests directly test conceptual equivalence, Berry et al. (2011) state that evidence of configural invariance supports claims regarding conceptual equivalence. Within the context of gender, post-partum depression items and the management of prostate cancer items may serve as examples of conceptual in-equivalence or uniqueness.

- *Configural invariance* (structural invariance, pattern invariance, the baseline model) involves testing whether or not the same items measure corresponding constructs across groups (Bialosiewicz et al., 2013). In an exploratory factor analysis the same items would load on the same factors, across groups. It simply implies that the zero or non-zero loadings on the factors (constructs) are the same across groups (Selig, Card, & Little, 2008). This could likewise be done through fitting the same CFA model to each group separately, running the CFA for each group, and comparing the fit indexes. Alternatively, and using a comprehensive statistic, running a multiple group analysis without any equality constraints will provide the information regarding configural fit (Van de Schoot et al., 2012). Once this baseline model is established, further testing of invariance can follow, as these results suggest some conceptual equivalence (Berry et al., 2011). No further comparisons, or further tests of MI between groups, are warranted should this level of invariance fail to materialise (Gunn, 2016).
- *Metric invariance* (weak invariance, loading invariance) builds upon configural invariance by requiring that in addition to the constructs being measured by the same items, the factor loadings of those items must be equivalent across groups (Bialosiewicz et al., 2013). Indicators (items) which are central to the construct in one group (men) should also be central in the other group (women), and those less central in the one group (men), should also feature less prominently in the other group (women) (Selig et al., 2008). Attaining invariance of factor loadings therefore suggests that the construct has the same meaning to participants across groups (Bialosiewicz et al., 2013). To test for MI at a metric level, a model where only the factor loadings are equal across groups (although the intercepts are allowed to differ between groups) should be run (Van de Schoot et al., 2012). If there is no significant difference in model fit, then there is evidence to suggest that the factor loadings are invariant

across groups. Attaining metric invariance suggests that group comparisons of factor variances and covariances are defensible. However, it does not justify the comparisons of group means (Bialosiewicz et al., 2013). [A violation of metric invariance implies non-uniform bias (Barendse, Albers, Oort, & Timmerman, 2015; Fontaine, 2008)].

- *Scalar invariance* (strong, full-score equivalence), builds upon metric invariance by requiring that the item intercepts also be equivalent across groups. To assess scalar invariance we compare the fit of the scalar model with the fit of the metric model (Bialosiewicz et al., 2013), which requires the running of a model where the loadings and intercepts are constrained to be equal (Van de Schoot et al., 2012). If there is no significant difference in model fit, then there is evidence to suggest intercept invariance. Item intercepts reflect the starting value of the scale on which the factor is based and then, given equivalent slopes (matric invariance), equivalent intercepts justify comparisons of the latent means across groups (Bialosiewicz et al., 2013; Van de Schoot et al., 2012). [Non-invariance of intercepts may be indicative of uniform bias (Barendse, Albers, Oort, & Timmerman, 2015; Fontaine, 2008).] Once scalar invariance is established, there is sufficient evidence to claim that the indicators are measuring the same underlying construct, and that any observed differences in the construct relate to veridical differences (Selig et al., 2008), therefore corresponding with reality or facts. This should be seen to signify that there are larger forces, such as cultural norms or developmental differences, that are influencing the way that participants respond to items across groups and that participants are systematically rating items either higher or lower (Bialosiewicz et al., 2013).
- *Strict invariance* (full-uniqueness, invariant uniqueness, strict factorial invariance) is concerned with residual error equivalence across groups (Bialosiewicz et al., 2013). It relates to the overall error in the prediction of the construct, as well as unique errors specific to particular indicator variables. When testing strict invariance, you are therefore essentially testing whether your residual error is equivalent across administrations (Bialosiewicz et al., 2013), implying a test of test reliability across groups. Strict invariance represents a highly constrained model and is rarely achieved in practice. Most agree that attaining strict invariance is unreasonable (Bialosiewicz et

al., 2013; Byrne, 2004; Chen, Carolina, Curran, Bollen, & Kirby, 2009; Vandenberg & Lance, 2000).

- *Latent mean invariance* (invariant factor means, latent mean analysis) builds upon the preceding levels of invariance, and refers to a test of the null hypothesis of equal factor means across groups (Vandenberg & Lance, 2000) to test for significant differences between groups on the level for the construct of interest (Gygi, Fux, Grob, & Hagmann-von Arx, 2016). Once latent mean invariance is achieved, it can be stated that not only does the different groups (for example men and women) perceive the items in the same manner, but also that their scores on the constructs are similar.

All tests for MI usually occur within a CFA framework (Vandenberg & Lance, 2000), where increasingly restrictive equality constrained hypotheses are tested (Bialosiewicz et al., 2013), and the parameters for the decision-making regarding these hypotheses are integrated below.

Analysis guidelines for measurement invariance

MI refers to the statistical property of a measurement instrument which indicates that the same underlying construct(s) is being measured across groups. This will be evident when the relationship between the manifest variables (the observed variables such as scale items and the subscale scores) and the underlying construct (the latent variable(s)) is the same across groups (Van de Schoot et al., 2015). The aforementioned makes sense when we assume that psychometric instruments are comprised of a single or several sets of items, which, when combined, are intended to assess a latent construct or constructs. Within the framework of CFA, it signifies that the common factor model holds across groups (Bialosiewicz et al., 2013). The guidelines presented below align with the assessment of independent clusters confirmatory factor analysis (IC-CFA) models.

The most commonly used test to check global model fit is the chi-square test (χ^2) (Millsap, 2011; Van de Schoot et al., 2012). It is a test of perfect fit of the "actual covariance and mean structure, and the covariance and mean structure implied by the hypothesised model" (Millsap, 2011, p. 93). The χ^2-statistic is dependent on the sample size, resulting in rejections of reasonable models if the sample is large and failure to reject poor models if the

samples are small (Van de Schoot et al., 2012). Although highly desirable, it can be expected that the hypothesis of perfect fit for models would be rejected in larger samples and for this reason the χ^2-statistic is no longer relied upon as a basis for acceptance or rejection of a model fit (Schermelleh-Engel, Moosbrugger, & Müller, 2003; Vandenberg, 2006). However, a statistically significant difference in χ^2 between a less constrained (e.g. metric invariance) and a more constrained model (e.g. scalar invariance) can be deemed as evident of a deteriorating model fit.

Kline (2010) suggests three more types of fit indices that can be used to assess the fit of a model:

- Firstly, the *comparative indices* compare the fit of the model under consideration with the fit of the baseline model. Examples of comparative indices are the Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI). Awang (2012), Hair, Black, Babin and Anderson (2009) and Van de Schoot et al. (2012) state that the model fit is acceptable when the TLI or CFI > .90, whilst others (Schreiber et al., 2006) set the margin at > .95. TLI or CFI values are acceptable > .90, and better if they are >.95. (Van de Schoot et al., 2012). TLI can also become > 1.0, which should be interpreted as overfitting the model, making it more complex than what was initially required. When comparing less constrained models to more constrained models within the MI context Vandenberg and Lance (2000, p. 46) note that "changes in CFI of -.01 or less indicate that the invariance hypothesis should not be rejected, but when the differences lie between -.01 and -.02, the researcher should be aware that differences exist. Definite differences between models exist when the change in CFI is greater than - .02".
- Secondly, there are *absolute indices* that examine closeness of fit, with the most used method being the Root Mean Square Error of Approximation (RMSEA) (Vandenberg & Lance, 2000). Some suggest that the cut-off value for RMSEA < .08, suggesting < .05 as better (Van de Schoot et al., 2012), whilst others suggest that the cut-off value should be RMSEA < .06 (Schreiber et al., 2006). Awang (2012) and Hair et al. (2009) suggest that the model fit is acceptable when RMSEA < .05. As no critical values for the change of RMSEA following the application of more constrained models could be located, the same principles as in the case of CFI could be followed where sequential model fits are compared.

- Thirdly, there are *information theoretic indices*, such as the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). AIC and BIC can be used to compare competing models (Van de Schoot et al., 2012), but should not be applied for the testing of a single model (Schreiber et al., 2006). Lower AIC or BIC values indicate a favourable trade-off between fit and complexity. Whilst the calculation of the actual AIC and BIC values is a very complex matter, the rule of thumb is to simply choose the model with the lowest AIC or BIC value as the best fitting model (Schreiber et al., 2006; Van de Schoot et al., 2012).

The indices used in this study as well as the parameters used when evaluating different models will be discussed in the method section of this article, under the heading "Analysis".

Method

The aim of the empirical study was to assess the level of MI across six instruments, using the same pool of respondents and then comparing the three assessments of MI of perceptions about the self (in the organisation) with the three measures on perceptions about an organisation (as an entity beyond the self). The discussion which will follow, the uniformity of the presence of gender-based MI in general, as well as the possible differences in MI reporting on the self, versus reporting on organisation, are presented.

Population and sampling

The target population comprised of men and women who were employed within organisations with more than 60 employees and who could report on their perceptions about their own behaviour, as well as on their respective organisations. Companies with more than 60 employees were targeted, as it was presumed that such organisations would have formalised organisational features which might make reporting more uniform. Organisations were included in the study based on their managers' willingness to grant permission to participate, resulting in a convenient sample of organisations. Respondents (employees) were randomly selected from personnel lists provided by the participating organisations. The

selection of respondents was therefore as random as possible, given the operational realities of recruiting respondents.

Measurement instrument

In total seven instruments were administered. The first three measured perceptions about organisation (as an entity beyond the self) and the rest measured perceptions about the self (in the organisation). Only brief descriptions of the instruments are provided below, so as to keep the article as concise as possible and in light of the fact that most of these instruments should be well-known to the reader.

- Brief Corporate Entrepreneurship Assessment Instrument (BCEAI; Hornsby, Kuratko, & Zahra, 2002; Strydom, 2013). Hornsby et al. (2002) are important authors with regard to the conceptualisation and measurement of an organisational climate associated with innovation in the workplace. They developed a 48-item questionnaire to assess five factors which influence innovation in the workplace: level of management support, work discretion or autonomy, rewards and reinforcement, time availability, and organisational boundaries (Hornsby et al. 2002). Strydom (2013) developed a brief version of the instrument, using only 20 items – four per factor. Strydom (2013) reports alphas of .73, .82, .74, .68 and .57 for the subscales and a reliability coefficient of .81 for the entire instrument. Strydom (2013) also reports information on the predictive validity of the instrument.
- HR Practices Scale (HRPS). The HRPS (Nyawose, 2009) was developed on a rational basis by examining the literature on different human resource management practices. Seven HRM practices were measured in this study, and the questionnaire consisted of 21 items. The HRPS has a hierarchical structure, with each of the seven factors consisting of three items. The factors are training and development, remuneration, performance management, supervisor support, staffing, diversity management, and communication. Nyawose (2009) reported reliabilities varying from .74 to .93, whilst Steyn (2012) reported Cronbach's alphas of .74 to .88. Nyawose (2009) and Steyn (2012) report results pertaining to the predictive validity of the HRPS.
- Multifactor Leadership Questionnaire (MLQ). The MLQ (Avolio, Bass, & Jung, 1995, 1999) is one of the most frequently used measures of leadership styles (Lowe, Kroeck, &

Sivasubramaniam, 1996) and measures transformational, transactional, and laissez-faire leadership styles, using 21 items. Dumdum, Lowe, and Avolio (2002) report acceptable reliability and validity for the MLQ in their meta-analysis. Remarkably, Eagly, Johannesen-Schmidt, and Van Engen (2003) published a study entitled *Transformational, Transactional, and Laissez-Faire Leadership Styles: A Meta-Analysis Comparing Women and Men,* without making any reference to MI.

- Employee engagement (UWES-9). This nine-item instrument measures three dimensions of employee engagement, namely vigour, dedication, and absorption (Schaufeli, Bakker, & Salanova, 2006). Schaufeli and Bakker (2003: 33) report that the "Cronbach's α of all 9 items varies from .85 to .94 (median=.91) across the 9 national samples. The α-value for the total database is .90". Schaufeli and Bakker (2003) also report that the suggested three-factor structure of engagement is confirmed (cross-samples from different countries) and that the construct is related to other constructs in the expected manner. De Bruin and Henn (2013) could not replicate the three-factor structure, and report "the presence of a very strong general factor and, in comparison, two weak group factors" (p. 788).
- Organisational commitment scale (OCS). The OCS was developed by Allen and Meyer (1990) to assess affective, continuance, and normative commitment, with eight items per dimension. Only the items of affective commitment were used, as it is common practice to interpret the sections of the test separately, and as affective commitment is an effective predictor of many organisational variables (Lamba & Choudhary, 2013; Wright & Kehoe, 2007). Allen and Meyer (1990) report an internal consistency coefficient of .86 for the affective commitment section, and comment that the "relationship between (though) commitment measures … and the antecedent variables … was, for the most part, consistent with prediction" (p. 13). This points to convergent and discriminant validity. Steyn (2012) reports a Cronbach's alpha coefficient of .82 for the eight items. Steyn, Bezuidenhout, and Grobler (2017) report relationships between affective commitment and antecedent variables consistent with what was expected.
- Innovative work behaviour (IWB). The 14 IWB items present elements descriptive of individual innovation, namely opportunity exploration, generativity, information investigation, championing, and application (Kleysen & Street, 2001). Hebenstreit (2003) reports an alpha of .94 when using all the items. Lu and Li (2010) could not replicate a five-

factor structure, and report Cronbach's alpha values of .86 for the two factors they extracted. Wojtczuk-Turek and Turek (2013) also report on a two-factor solution, with values of .88 and .89. Though empirical support for the theorised structure was mixed, Kleysen and Street (2001) suggest the use of the items as a single measure of innovation behaviour, as did Hebenstreit (2003). In this study the original five elements were used in the measurement model which was tested.

- Individual pro-activeness (IPA). The 17-item instrument was developed to "investigate a personal disposition towards proactive behavior, defined as the relatively stable tendency to effect environmental change" (Bateman & Crant, 1993, p. 103). It was established through factor analyses that the 17-item instrument is a unidimensional scale with sound psychometric properties, including coefficient alphas varying from .85 (Crant & Bateman, 2002) to .93 (Crant, 1996). Information on discriminant and predictive validity is also provided by the developers (see Bateman & Crant, 1993; Seibert, Kraimer, & Crant, 2001). Conceptually the instrument seems well accepted by researchers as a test of pro-activeness and a predictor of important organisational outcomes (see Thomas, Whitman, & Viswesvaran, 2010).

Analysis

Descriptive statistics on all seven measures were calculated using SPSS. These included per gender means and standard deviations, as well as kurtosis and skewness. Within the context of SPSS, significant deviations from normality occur when the skewness/standard error of skewness or kurtosis/standard error of kurtosis has an absolute value greater than 2 (Weinberg & Abramowitz, 2008). Field (2009, p. 139) seems more lenient, and is comfortable with values below 3.29, also warning against using skew and kurtosis tests in large samples ($N > 200$), suggesting a visual inspection of the distribution rather than using significance tests because of their sensitivity. In this study the skewness or kurtosis > 3 will be interpreted as a deviation from normality.

MI pertaining to gender was tested for in each of the seven instruments. Following the recommendations of Vandenberg and Lance (2000), pairwise multigroup confirmatory factor analyses with robust maximum likelihood estimation (Wu et al., 2007) were used to examine configural, metric, intercept, and strict invariance as well as, finally, the equivalence

of the latent means. The analyses were performed using the lavaan package (Rosseel, 2012) in R (R Core Team, 2013).

As a non-significant χ^2-statistic is highly unlikely given the sample size (Schermelleh-Engel, Moosbrugger, & Müller, 2003; Vandenberg, 2006), it will not be used as a decisive indicator of model fit. The χ^2-statistic will only be reported should it be non-significant. Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), Comparative Fit Index (CFI), Root-Mean-Square Error of Approximation (RMSEA), as well as changes in CFI (ΔCFI) and changes in RMSEA (ΔRMSEA), were used to test for model fit. The selection of the particular indices was also informed by the standard outputs of the statistical software used.

Following on the discussion presented earlier in this text, the models with the lowest AIC and BIC values were judged as the best fitting models. CFI values > .90 were judged adequate and leniently RMSEA values < .08 as acceptable. With regard to both ΔCFI and ΔRMSEA, a change greater than .01 was seen as an indicator of a deteriorating model, with changes greater than .02 seen as a clear sign of differences between the models.

Results

Demographics

Respondents from 52 organisations participated in the study. In total 3 180 questionnaires were completed. More men (55.3%) than women (47.7%) women completed the questionnaires. All the major race/ethnic groups were represented, with 58% Black, 24% White and 8% for Asian and Mixed ethnicity each. The mean age of the respondents was 37.8 years (standard deviation 9.1). For tenure the mean was 9.0 years (standard deviation 7.5). Due to the large number of organisations included in the study, and the diversity in terms of gender, race, age, tenure, the respondents were heterogeneous and relatively free from any particular context, which some authors (Els, Mostert, & Brouwers, 2016) deem appropriate to assess bias and equivalence.

Descriptive statistics

In Table 1 descriptive statistics per gender are presented. Data for 3 143 respondents were available, with a split of 56.4% men and 43.6% women. In all but one instance (IWB – women), the skewness was negative, and in only one case it fell within the threshold of being smaller than 3 (IWB – men). Inspection of the distributions also showed high levels of negative skewness. Although skewness was found in most cases, it was not deemed as problematic, as social desirability, acquiescence, and leniency are common in organisational research response patterns, with all these elements contributing to negative skewness (Spector & Brannick, 2009). Unlike skewness, several of the kurtosis values were within the normality range, with the clear exception being IPA, for both men and women. Despite these deviations, it was decided to continue with further analyses, given the appropriate and adequate sample size, and particularly the similarity in the distributions across gender.

Table 1
Descriptive statistics, skewness, kurtosis and reliability

	Gender	N	Mean	Std. Dev.	Std. Error Mean	Skew. / Std. Error of Skew.	Kurt. / Std. Error of Kurt.	Alpha
BCEAI	Men	1773	66.07	9.320	.221	-4.97	1.76	.762
	Women	1370	65.39	9.176	.248	-4.48	2.55	.755
HRMP	Men	1773	71.36	15.363	.365	-5.32	-1.98	.928
	Women	1370	71.04	15.194	.411	-4.68	.43	.931
Transformational Leadership	Men	1773	2.31	.872	.021	-8.86	-2.59	.942
	Women	1370	2.33	.912	.025	-8.09	-2.66	.952
Transactional Leadership	Men	1773	2.52	.975	.023	-8.85	-1.96	.821
	Women	1370	2.48	1.030	.028	-7.15	-3.55	.831
Laissez-Faire Leadership	Men	1773	2.18	.831	.020	-2.37	.32	.530
	Women	1370	2.23	.874	.024	-3.31	-.74	.570
IPA	Men	1773	53.29	8.316	.197	-14.90	13.81	.872
	Women	1370	52.90	8.856	.239	-8.97	10.50	.890
UWES-9	Men	1773	38.23	9.904	.235	-10.32	.59	.894
	Women	1370	37.68	10.428	.282	-9.96	1.58	.908
OCS	Men	1773	36.66	9.319	.221	-4.39	-2.63	.774
	Women	1370	35.66	9.396	.254	-3.41	-.80	.778
IWB	Men	1773	37.44	9.426	.224	-.73	-1.47	.947
	Women	1370	35.75	9.745	.263	3.63	-1.33	.954

It is noteworthy that skewness and kurtosis values were specific to particular instruments – and not to gender.

Reliability

The reliability coefficients for the instruments are presented in the last column of Table 1. Apart from the very low coefficient for the 3 items of the measures of Laissez-Faire leadership, the coefficients were moderate to high, with similar values across gender, and female respondents providing mostly more reliable responses.

Mean differences

Mean and mean differences were calculated, whilst remaining cognisant that means may differ because of bias rather than substantive differences between men and women. These are presented in Table 2.

Table 2
Descriptive statistics, mean differences and reliability

	Gender	Mean	Std. Deviation	Diff	Std. Error Diff	t	p	Cohen d-value
BCEAI	Men	66.07	9.320	.672	.333	2.017	.044	.072
	Women	65.39	9.176					
HRMP	Men	71.36	15.363	.327	.550	.594	.553	.021
	Women	71.04	15.194					
Transformational Leadership	Men	2.31	.872	-.020	.032	-.634	.526	-.023
	Women	2.33	.912					
Transactional Leadership	Men	2.52	.975	.036	.036	.988	.323	.035
	Women	2.48	1.030					
Laissez-Faire Leadership	Men	2.18	.831	-.056	.031	-1.818	.069	-.065
	Women	2.23	.874					
IPA	Men	53.29	8.316	.394	.308	1.282	.200	.045
	Women	52.90	8.856					
UWES-9	Men	38.23	9.904	.552	.365	1.513	.130	.054
	Women	37.68	10.428					
OCS	Men	36.66	9.319	.998	.336	2.967	.003	.106
	Women	35.66	9.396					
IWB	Men	37.44	9.426	1.686	.344	4.900	>.001	.175
	Women	35.75	9.745					

From Table 2 it can be observed that the mean scores differed significantly ($p < .01$) on two instruments, OCS and IWB. When considering the Cohen d-values, which is an expression of the difference in terms of standard deviation units, the difference was 10.6% of one standard deviation for OCS and 17.5% of one standard deviation for IWB. These differences have a small practical effect size.

Gender-based measurement invariance

All calculated χ^2-statistics were significant, necessitating the rejection of the hypotheses of perfect fit for all models, across all instruments. This result was not interpreted negatively, given the large sample size (Schermelleh-Engel, Moosbrugger, & Müller, 2003; Vandenberg, 2006).

In Table 3 the MI results pertaining to each instrument are presented. When applying both CFI and RMSEA, four of the seven instruments showed configural MI (BCEAI, HRMP, Leadership Styles and IWB), whilst three instrument (IPA, UWES-9, and OCS) did not

meet the CFI > .90 and RMSEA < .08 criteria. The last mentioned three instruments were therefore deemed as non-MI and the first four as MI, at a configural level.

Table 3
Measurement invariance per instrument

BCEAI						
Invariance Level	AIC	BIC	CFI	RMSEA	ΔCFI	ΔRMSEA
Configural	173142	173 986	.92	.045	-	-
Metric (Loadings)	173154	173 908	.91	.045	.002	>.001
Scalar (Intercepts)	173167	173 830	.91	.044	.002	>.001
Strict (Residuals)	173152	173 694	.91	.043	>.001	.001
Equal Latent Means	173151	173 664	.91	.043	>.001	>.001
HRMP						
Invariance Level	AIC	BIC	CFI	RMSEA	ΔCFI	ΔRMSEA
Configural	159 431	160 436	.97	.045	-	-
Metric (Loadings)	159 422	160 343	.97	.044	>.001	.001
Scalar (Intercepts)	159 405	160 243	.97	.043	>.001	.001
Strict (Residuals)	159 403	160 115	.97	.043	.001	.001
Equal Latent Means	159 390	160 060	.97	.042	>.001	.001
Leadership Style						
Invariance Level	AIC	BIC	CFI	RMSEA	ΔCFI	ΔRMSEA
Configural	171244	172040	.923	.074	-	-
Metric (Loadings)	171220	171908	.923	.073	>.001	.002
Scalar (Intercepts)	171220	171799	.923	.071	>.001	.001
Strict (Residuals)	171223	171676	.922	.070	.001	.001
Equal Latent Means	171230	171664	.922	.070	>.001	>.001
IPA						
Invariance Level	AIC	BIC	CFI	RMSEA	ΔCFI	ΔRMSEA
Configural	112376	112991	.814	.104	-	-
UWES-9						
Invariance Level	AIC	BIC	CFI	RMSEA	ΔCFI	ΔRMSEA
Configural	88122	88484	.951	.099	-	-
OCS						
Invariance Level	AIC	BIC	CFI	RMSEA	ΔCFI	ΔRMSEA
Configural	97205	97496	.731	.175	-	-
IWB						
Invariance Level	AIC	BIC	CFI	RMSEA	ΔCFI	ΔRMSEA
Configural	107743	108371	.976	.060	-	-
Metric (Loadings)	107737	108310	.976	.059	>.001	.002
Scalar (Intercepts)	107724	108243	.976	.057	>.001	.002
Strict (Residuals)	107795	108230	.974	.057	.003	.001
Equal Latent Means	107821	108225	.973	.057	.001	>.001

Further analyses were therefore performed for BCEAI, HRMP, Leadership Styles and IWB. When considering higher levels of MI, acceptable CFI and RMSEA, as well as small ΔCFI and ΔRMSEA, were considered. All of BCEAI, HRMP, Leadership Styles and IWB met the CFI and RMSEA as well as small ΔCFI and ΔRMSEA criteria for metric, intercept, and strict invariance, as well as ultimately equivalence of the latent means.

For BCEAI, HRMP, Leadership Styles and IWB, the BIC statistic also reflects that the best fit is at the highest level, i.e. equal latent means. The AIC statistic does not follow the same pattern, and only in the case of HRMP the AIC and BIC statistic overlaps. Only HRPM therefore revealed a consistent fit picture for all the selected indices. BCEAI, Leadership Styles and IWB met five of the six criteria for fit at equal latent means level.

Discussion

From the literature reviewed it is evident that testing for MI when doing cross-group comparisons is important and that the concepts associated with MI and the measurement thereof are straightforward and performed without much effort. Although these analyses are sometimes performed, it is not routine practice, even in journals specifically focusing on gender matters. Without denying the presence of MI in some studies focusing on gender, other fields of research have made great progress in this regard. Within cross-cultural research, for example, MI has become almost a standard reporting point at conferences such as the *International Association for Cross-Cultural Psychology*. This paper lobbies for conducting MI by those interested in making cross gender comparisons and present the reader with an introduction to the topic as well as with some guidelines on the interpretation of MI outputs.

The large number of organisations included in the study and the diversity of the respondents suggest a heterogeneous sample which was relatively free from any particular context and therefore deemed appropriate to assess bias and equivalence (Els, Mostert, & Brouwers, 2016). More men (56.4%) than women (43.6%) respondents completed the questionnaires. This could be seen as a result of the random selection of respondents within organisations, and is reflective of the workforce in South Africa (see Statistics South Africa (2018)), which comprise of more men than women.

When testing for the normality of the distribution of the data, it was found that most scales showed statistically significant negative skewness, which was confirmed when inspecting the distribution curves. This was, however, not deemed problematic, as this phenomenon often occurs when surveys are used within organisations assessing positively perceived constructs (Spector & Brannick, 2009). All but one of the kurtosis values were within the normality range, and in that case the statistic was similar for both men and women. Most telling was that the distributions for males and females were similar across the different measurements, regarding both skewness and kurtosis. With regard to reliability, the coefficients ranged from low to high, with most being acceptable. As in the case of the distribution statistics, the reported coefficients for men and women were similar and mirrored each other.

When comparing observed means scores, significant differences were found for OCS and IWB, with men scoring higher than women on both measures. These difference had a small practical effect size. However, it could be asked whether these (small) differences are substantive or based on bias in the instruments?

The question of MI becomes pertinent in answering the abovementioned question. The results of the MI tests are reported in Table 3. For three instrument, namely UWES-9, IPA and OCS, the MI analysed showed that, at a configural level, men and women differed in their understanding of the construct. The same items did not measure corresponding constructs across groups (Bialosiewicz et al., 2013), or stated differently, the same items did not load on the same factors across groups. No further analyses are warranted (Gunn, 2016) should this level of non-invariance be detected. It should thus be concluded that the UWES-9, IPA and the OCS function in a way that the domain or trait does not makes sense in the same manner for men and women. This is a very serious "accusation", as the UWES-9 (Schaufeli, Bakker, & Salanova, 2006) and the OCS (Allen & Meyer, 1990) are frequently used in research across the globe.

As stated before, in all cases the χ^2-test of perfect fit for all models was rejected. However, when considering the CFI, RMSEA, ΔCFI, ΔRMSEA and BIC, the criteria for equivalence of the latent means were met for the other four instruments, namely BCEAI, HRMP, Leadership Styles, and IWB. This signifies that these instruments met the MI criteria at the configural, metric, intercept, and strict invariance levels. On these measures men and

women did not differ in the way they perceived the construct (configural MI), the way the items and the constructs relate (metric MI), the absolute weighting of the constructs (intercept MI), the errors associated with the measurements (strict MI) as well as their mean scores on the latent constructs (equivalence of the latent means). Regarding BCEAI, HRMP, Leadership Styles and IWB, users may therefore use these scales knowing gender comparisons of factor variances and covariances are defensible (metric MI), mean differences comparison are secure (intercept MI), reliability is similar (strict MI), and that scores for men and women on the latent constructs are similar (equivalence of the latent means).

Much "neater" results would have been achieved should this reporting have excluded AIC. AIC indicated – only for HRMP – that the optimal model was at the level of equivalence of the latent means. For the other qualifying instruments (BCEAI, Leadership Styles and IWB) scores varied, showing lover levels of fit. However, MI at equivalence of the latent means was accepted, given the overwhelming evidence to that effect. Clearly the number and selection of parameters may also influence the reports. Cherry-picking of parameters is discouraged as this may result in falsification. Therefore specifying parameters before analyses commence is recommended.

Interesting to note was that in all the cases where configural invariance was achieved, the more constrained models were also satisfactory tested. Stated differently, in none of the cases where configural invariance was attained, it was not eventually followed by providing confirmatory information on MI at the equal latent means level. The additional constraints seemed to not influence the initially obtained statistics considerably. Future research with other instruments could explore this matter further.

Given the results of the MI tests, it could be stated that the observed mean differences (see Table 2) between men and women on OCS may be due to measurement bias, as men and women perceive the concept differently. As far as the observed differences in IWB are concerned, it can be concluded that men show more IWB than women, and that they perceive the concept in the same manner. At a latent variable level, however, the means of men and women on IWB are equivalent (see Table 3). Men and women also perceive BCEAI, HRMP and Leadership Styles in a similar manner, and their standing on these constructs does not differ – not at an observed or a latent mean level. These instruments may be used with confidence when comparing men and women.

Conclusion

In the article the call for testing of gender-based MI in studies where men and women are compared is answered through discussing the topic of MI and the rationale of testing in an unassuming matter, which allows for easy access to the topic. In the article the interpretation of the different statistics created with the lavaan package (Rosseel, 2012) in R (R Core Team, 2013) is also operationalised, allying it to seven different instruments. This should make the problems associated with the interpretation of MI results clear to prospective researchers who want to test for MI. Researchers interested in the structure of group differences therefore have no reason not to investigate MI as a routine part of research, as called for by Borsboom (2006). The most significant contribution of this paper is the complexity created when testing MI across several scales (using the same set of respondents). The different configurations of the results regarding MI add depth to the discussion on MI and the decision rules which are prescribed. The serratedness of results emphasised the necessity of testing for MI when comparing groups and the structures which underline such measurement. It is recommended that MI be used as a standard procedure as these tests can be performed and interpreted with ease. Further research on how or why configural invariance "inevitably" leads to equal latent means is encouraged. The findings also allow prospective users of instruments tested in this research to apply those instruments which showed MI confidently, knowing that these are equivalent across gender.

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CHAPTER 6: GENDER DIFFERENCES IN THE RELATIONSHIP BETWEEN INNOVATION AND ITS ANTECEDENT

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Article 5: Gender differences in the relationship between innovation and its antecedent ……..

Abstract

Background: Gender is often linked to innovation, suggesting that innovation is specific to individuals of a specific gender, but most often that gender diversity in teams contributes to innovation. In a previous study it was demonstrated that only in some cases do men and women interpret questionnaires assessing innovation, and the antecedents thereto, similarly, indicating that measurement invariance is only sometimes achieved. Aim: The aim of this study was to go beyond measurement invariance and assess whether innovation and its antecedents relate to each other in the same way for men as for women when using measurement invariant instruments. Setting: The sample represents 52 South African organisations, with 60 employees from each, amounting to 3 143 respondents, of which 56.4% were men and 43.6% women. Method: Four instruments, of which the measurement invariance across gender has been determined, were included in the study. The relationship between innovation and its antecedents was assessed by performing both correlation and regression analyses for men and women separately, and comparing the findings. Thereafter, gender was introduced as moderator between innovation and its antecedents. Results: The results reveal that the relationships between innovation and its antecedents do not differ practically across gender, nor does gender moderate the relationship between these variables. Conclusion: Although gender and gender diversity is often associated with innovation, this research reveals that gender does not alter the way the antecedents to innovation influence innovation at an individual level. These findings, however, reveal that gender acts as a substantive antecedent to innovation, and they emphasise the importance of applying quantitative and sophisticated techniques when conducting gender-specific research.

Key words: Gender, innovation, psychometrics, differences, innovative work behaviour

Background

The facilitating role of gender diversity in innovation is generally accepted, although empirically unresolved, as some researchers have found a link between gender diversity and innovation (PR Newswire US, 2013; Ruiz-Jiménez, Fuentes-Fuentes, & Ruiz-Arroyo, 2014), while others suggest that such findings are context specific (Parrotta, Pozzoli, & Pytlikova, 2014), "neither direct nor definitive" (McMahon, 2010, p. 44). Others, meanwhile, report that groups of women "were no more innovative than all-male teams, nor were there any significant differences in the variety of alternative solutions" they produced (Fila, & Purzer, 2014, p. 1405). Some researchers argue that the "diversity can be either conducive or detrimental to team innovation" (Mitchell, & Boyle, 2015, no page), while Fernández (2015) and Sastre (2014) posit that an inverted-U relationship exist between gender diversity and innovation outputs, but did not find this under all circumstances. The prevalence of mixed findings from diversity studies implies that the business case for the benefits of diversity is not conclusive (Tatli, 2011; Wentling, 2004).

This research is not about gender diversity, but rather about a more contentious issue, namely that of the differences between men and women actors when engaging in innovation. Previous innovation research has focused on gender differences regarding characteristics and motivations, leadership style, strategic choices, obstacles and results (Pablo-Martí, García-Tabuenca, & Crespo-Espert, 2014). Sonfield, Lussier, Corman, and McKinney (2001) state that results of prior research pertaining to gender and innovation are mixed, as is the case with gender diversity. Differences were found on some aspects, such as motivations and intentions, (Sánchez-Escobedo, Díaz-Casero, Díaz-Aunión, & Hernández-Mogollón, 2014; Pablo-Martí et al., 2014), overall satisfaction (Sonfield et al., 2001), commitment to product and service innovation (Pablo-Martí et al., 2014), and resilience (Cañizares & García, 2010). On other aspects, such as the strategies applied (Sonfield et al., 2001) and reasons for success and survival (Pablo-Martí et al., 2014), men and women reported substantially in the same manner. Lee and Marvel (2014) question past research findings which have reported gendered outcomes, and conclude that resource and context characteristics fully mediate the gender-innovation relationship. Kvidal and Ljunggren (2014) boldly report that gender is a non-issue in terms of innovation.

Important to this study is the measurement of innovation and the antecedents thereto. Assessment may play an important role in gender research, as gender is significant in how profiles are perceived (Sánchez-Escobedo, Díaz-Casero, Hernández-Mogollón, & Postigo-Jiménez, 2011). Alsos, Ljunggren, and Hytti (2013) claim that, when analysing gender and innovation, it is possible to interpret innovation as a gender-biased phenomenon. When using a gender-aware operationalisation of innovation, no significant difference in innovativeness was found between men and women (Nählinder, Tillmar, & Wigren, 2015). Research on innovation should consider the gender neutrality of the operationalisation used in the study (Nählinder et al., 2015), and Alsos et al. (2013) state that it is imperative to develop and apply new methodological approaches as well as new operationalisations of innovation and innovators.

This research will focus on such new technologies. It will not attempt to produce gender-aware operationalisations versions of the standardised measures used in this study, but will rather seek assurance that the measures used are measurement invariant. Measurement invariance (MI) reflects the extent to which an observed score on the measurement is reflective of an individual's standing on a construct, independent of his or her group membership (Mellenbergh, 1989; Meredith, 1993; Meredith & Millsap, 1992; Wu, Li, & Zumbo, 2007). Once MI is achieved, substantive gender-based comparisons resulting from the measurement should be done (Salzberger, Newton, & Ewing, 2014).

In this research, gender differences in the relationship between innovation and its antecedents will be assessed, making use of instruments tested to be measurement invariant. This type of research is rare in the organisational behaviour domain, and although gender is often included as a variable in studies (Eagly, Johannesen-Schmidt, & Van Engen, 2003; Reuvers, Van Engen, Vinkenburg, & Wilson-Evered, 2008), only a few researchers engage with the matter of MI (Xu, Wubbena, & Stewart, 2016) before conducting further analyses. The study aims to contribute to management science by specifying the importance of the gender of individual employees when facilitating innovation within the organisation and when applying managerial actions such as implementing the most suitable leadership style and human resources practices, and creating an organisational climate conducive to innovation.

Literature review

Innovation in the workplace, which could be described as the propensity of an organisation to deviate from conventional industry practices by creating or adopting new products, processes or systems (Overstreet, Hanna, Byrd, Cegielski, & Hazen, 2013), is an essential component for competitiveness and survival (Gunday, Ulusoy, Kilic, & Alpkan, 2011), and considered by many scholars as one of the most important determinants of firm performance (Adegoke, Walumbwa, & Myers, 2012; Durán-Vázquez, Lorenzo-Valdés, & Moreno-Quezada, 2012; Grant, 2012). From a managerial perspective, it is important to identify the antecedents to innovation, differentiate between important and less important drivers of innovation, and manage these drivers in an effective manner (Bigliardi 2013; Ndregjoni & Elmazi 2012). According to Yen (2013), the facilitation of innovation is an essential management function of managers, as it is interconnected with organisational performance.

Research findings on the antecedents to innovation within organisations are readily available. Reports indicate that the nature of human resource management (HRM) practices (Sanz-Valle & Jiménez-Jiménez, 2018; Veenendaal, 2015) could predict innovation. Leadership (Atitumpong & Badir, 2017; de Jong & Den Hartog, 2007; Scott & Bruce, 1994), and specific leadership styles (Reuvers et al., 2008; Vargas, 2015) have also been linked to innovation. Along similar lines, organisational culture and climate has been linked to innovation (Baer & Frese, 2003; Goodale, Kuratko, Hornsby, & Covin, 2011; Hornsby, Kuratko, & Zahra, 2002; Lukes & Stephan, 2017; Sethibe & Steyn, 2016). More complex models, involving leadership style, climate, and innovation (Sarros, Cooper, & Santora, 2008; Sethibe, & Steyn, 2018) HRM, organisational culture and innovation (Al-Bahussin & Elgaraihy, 2013; Fellnhofer, 2018) have been tested, linking these variables.

Within the organisational behaviour context, “literature on diversity in organisations is limited” and more specifically to this study, “even fewer studies investigate its impact on innovation” (Díaz-García, González-Moreno, & Sáez-Martínez, 2013, p. 149). Although there seems to be consensus in the literature that certain antecedents drive innovation, the research on this relationship involving or including gender is limited (Eagly et al., 2003; Reuvers et al., 2008). This scarcity of research focusing on gender is widespread in academic publishing, but peculiar “given the centrality of gender in human life” (Byrne, 2015, no page). Most of the research on the antecedents to innovation is void from an individual gender

angle. This is worrisome, as gender is often associated with innovation in organisations (Nählinder et al., 2015). An exception to this may be the research of Reuvers et al. (2008) which reports a positive and significant relationship between transformational leadership and innovative work behaviour, and that the gender of the manager moderated the latter relationship, with employees being more innovative when the transformational leadership is displayed by men, compared to women managers. Mahto, McDowell, Kudlats, and Dunne (2018) found that the gender of the manager did not moderate antecedent-innovation relationships, nor did Pretorius, Millard, and Kruger (2005) find any gender moderation. In none of these cases was MI considered. Within the innovation domain, only the previously mentioned Xu et al. (2016) conducted MI analyses before comparing groups, which is the approach to be followed in this research.

In summarising the present literature on antecedents to innovation, it could be said that a multitude of studies specify these variables, and in many cases specify the importance of each variable relative to others. However, research focusing on the gender of those employees who are to be influenced to act innovatively is sparse. This sparsity of research linking antecedents to innovation and also including a gender angle – and specifically the dearth of gender-related measurement invariant in such studies – explains the length of this literature review, as well as the importance of conducting original research of this nature.

Method

A cross-sectional survey design was used to collect quantitative data. In this section, the population and sampling, the instruments for collecting data, as well as the way the data were analysed, are discussed.

Population and sampling

The population targeted all employees in South Africa. Conveniently, 52 organisations were sorted to participate in the study. In each of the organisations, random samples were drawn until complete data from 60 respondents were collected. The organisations selected included a broad spectrum of government and private sector organisations, each with more than 60 employees. Both men and women were represented adequately in the sample and details in

this regard are presented in the findings section.

Measurement instruments

Seven instruments were administered, namely the Brief Corporate Entrepreneurship Assessment Instrument (BCEAI) (Hornsby, Kuratko, & Zahra, 2002; Strydom, 2013), the Human Resources Practices Scale (HRPS) (Nyawose, 2009; Steyn, 2012), the Multifactor Leadership Questionnaire (MLQ) (Avolio, Bass, & Jung, 1995, 1999), the Individual Pro-activeness (IPA) (Bateman & Crant, 1993), employee engagement (UWES-9) (Schaufeli, Bakker, & Salanova, 2006), Organizational Commitment Scale (OCS) (Allen & Meyer, 1990) and the Innovative Work Behaviour (IWB) (Kleysen & Street, 2001). After testing for measurement invariance across gender (see Steyn and de Bruin, 2019)[9], only the BCEAI, HRPS, MLQ, and the IWB were retained as these instruments showed measurement invariance. A short description of each of the retained instruments is presented below.

The Corporate Entrepreneurship Assessment Instrument was developed by Hornsby et al. (2002). Hornsby et al. (2002) are important authors with regard to the conceptualisation and measurement of an organisational climate associated with innovation in the workplace. They developed a 48-item questionnaire to assess five factors that influence innovation in the workplace: level of management support; work discretion or autonomy; rewards and reinforcement; time availability; and organisational boundaries (Hornsby et al. 2002). Strydom (2013) developed a brief version of the instrument, using only 20 items, four per factor. Strydom (2013) reports alphas of .73, .82, .74, .68 and .57 for the subscales and a reliability coefficient of .81 for the entire instrument. Strydom (2013) also reports information on the predictive validity of the instrument. Steyn and de Bruin (2018b) were able to replicate the factorial structure as proposed by Strydom (2013) across gender (Equal latent means invariance; CFI=.91 and RMSEA=.043). They report the Cronbach's alpha for the total questionnaire to be .76, with .76 for men and .75 for women respectively.

The HRPS (Nyawose, 2009) was developed on a rational basis by examining the literature on different human resource management practices. Seven HRM practices were measured in this study, and the questionnaire consisted of 21 items. The HRPS has a

[9] Please contact the first author should the data be required.

hierarchical structure, with each of the seven factors consisting of three items. The factors are training and development; remuneration; performance management; supervisor support; staffing; diversity management; and communication. Nyawose (2009) reported reliabilities varying from .74 to .93, whilst Steyn (2012) reported Cronbach's alphas of .74 to .88. Nyawose (2009) and Steyn (2012) report results pertaining to the predictive validity of the HRPS. Steyn and de Bruin (2018a) were able to replicate the factorial structure as proposed by Nyawose (2009) and Steyn (2012) across gender (Equal latent means invariance; CFI=.97 and RMSEA=.042), and report reliabilities for the seven scales which were "uniformly satisfactory and similar across men and women", varying from .73 to .84 for men and .71 to .85 for women.

The MLQ (Avolio et al., 1995, 1999) is one of the most frequently used measures of leadership styles (Lowe, Kroeck, & Sivasubramaniam, 1996) and measures transformational, transactional, and laissez-faire leadership styles, using 21 items. Dumdum, Lowe, and Avolio (2002) report acceptable reliability and validity for the MLQ in their meta-analysis, Ridder (2015), also following a meta-analysis, reports that that the MLQ shows a "consistent pattern of results (and) is reassuring considering the results are similar across time, not tied to one particular version of the MLQ or influenced by particular outcome variables" (pp. 25). Steyn and de Bruin (2019) were able to replicate the differentiated leadership types as proposed in the MLQ across gender (Equal latent means invariance; CFI=.92 and RMSEA=.070), and report acceptable Cronbach's alphas of .94 (men) and .95 (women) for transformational leadership, .82 (men) and .83 (women) for transactional leadership, and low reliability for the laissez-faire leadership styles, with .53 for men and .57 for women.

The 14 IWB items present elements descriptive of individual innovation, namely opportunity exploration, generativity, information investigation, championing, and application (Kleysen & Street, 2001). Hebenstreit (2003) reports an alpha of .94 when using all the items. Lu and Li (2010) could not replicate a five-factor structure, and report Cronbach's alpha values of .86 for the two factors they extracted. Wojtczuk-Turek and Turek (2013) also report on a two-factor solution, with values of .88 and .89. Though empirical support for the theorised structure was mixed, Kleysen and Street (2001) suggest the use of the items as a single measure of innovation behaviour, as did Hebenstreit (2003). Steyn and de Bruin

(2019b) were able to replicate the five-factor structure of IWB as proposed by Kleysen and Street (2001). Steyn and de Bruin (2019a) also demonstrated that the measure was invariant across gender (Equal latent means invariance; CFI=.973 and RMSEA=.057), and report alphas coefficients of .94 (men) and .95 (women).

The instruments included in these analyses were selected on the basis that they were measurement invariant (MI) across gender. It is important to note that the Individual Pro-activeness (IPA) (Bateman & Crant, 1993), employee engagement (UWES-9) (Schaufeli et al., 2006), Organizational Commitment Scale (OCS) (Allen & Meyer, 1990) did not show MI. Instruments biased in the way they assess the selected antecedents to innovative work behaviour were thus excluded.

Statistical analyses

As stated above, the instruments included in these analyses were selected on the basis that they were measurement invariant across gender in this sample. Thus, no test of MI was performed here. The focus of the analyses was on gender differences in the way the MI variables relate to each other, specifically with IWB as an outcome. Three types of analyses were performed.

Firstly the correlation between the independent variables and IWB was calculated for both men and women. Z-observed scores were calculated to determine if these correlations differ significantly from each other. Z-observed = $(Z_1–Z_2)$ / square root of $[(1/N_1\text{-}3) + (1/N_2\text{-}3)]$, with Z_1 and Z_2 the Z-scores for the correlation of Group 1 and Group 2 respectively, and N_1 and N_2 the size of Group 1 and 2 (Field, 2009). In this case, Group 1 would be men and Group 2 women. Z-observed scores between (+/-) 1.64 and 1.96 are indicative of significant differences in the correlations at $p<.05$, and Z-observed scores higher than (+/-) 1.96 are indicative of a significant between the correlations at $p<.01$ (Pallant, 2013). When Z-observed scores are thus smaller than between (+/-) 1.64, it will be assumed that the differences in the correlations are not significant.

Using SPSS-25 (IBM SPSS Statistics, 2017), regression analyses were performed, where the subcomponents of the different measures were used as predictors of IWB, splitting the file along gender lines. Here, the aim was to test if the models fitted equally well

for men and women (considering the coefficient of determination – R^2), and to identify possible differences in the extent to which the subcomponents predict IWB along gender lines. An R^2>.02 was deemed as a significant difference. Subcomponents were deemed similar when the significance of the loadings was similar. As the sample sizes are relatively large (N>1 000), the more stringent cut-off of p<.01 was used to indicate significance.

Moderation was tested as per the procedures suggested by Mackinnon (2010). This involves doing a regression without including the moderator as a variable in the regression (Model 1), and only then adding the moderator (gender; Model 2), and finally adding the moderator and the interaction effect (predictor variable x moderator; Model 3). In general, the interest is in ΔR^2, using Model 1 as a baseline model. If ΔR^2 is positive and significant across models, this suggests improved models, and the specific importance of adding the additional variable. In the later models, the significance of the beta values is interpreted. Should gender directly predict IWB (Model 2), this is indicative of a direct effect, making it an antecedent to IWB. This also implies that the intercepts of the regression lines differ per gender. Should the interaction between gender and any subcomponent be significant (Model 3), this is indicative of gender moderating the relationship between that subcomponent and IWB. This implies that the slopes of regression lines differ per gender. ΔR^2>.02 and beta scores with p<.01 were considered as significant.

Results

Demographics

Data were collected from 1 773 men and 1 370 women, across more than 52 organisations. The respondents were representative of all race/ethnic groups in South Africa, with a mean age of 37.8 years (standard deviation 9.1). The mean for tenure was 9.0 years (standard deviation 7.5). The pool of respondents was heterogeneous, including diversity regarding gender, race, age, tenure, and relatively free from any particular context, which would make them appropriate for use in assessing bias and equivalence (Els, Mostert, & Brouwers, 2016).

Mean scores and mean score differences

Mean scores and mean score differences are presented in Table 1.

Table 1

Mean scores and mean differences, as per Cohen d-values, per gender

Test	Men Mean	Std.dev.	Women Mean	Std.dev.	Mean diff.	Cohan d
1 IWB	54.179	13.105	51.548	13.158	2.631	.200
2 LSTForm	2.316	.871	2.336	.912	-.020	-.022
3 LSTSact	2.523	.975	2.488	1.020	.035	.035
4 LSLFair	2.180	.831	2.235	.874	-.055	-.064
5 HRG1T&D	11.367	3.130	11.311	2.949	.036	.011
6 HRG2Rem	9.025	3.091	8.961	3.148	.064	.020
7 HRG3Pm	9.992	2.787	9.961	2.759	.031	.011
8 HRG4Sup	10.583	2.889	10.520	2.967	.063	.021
9 HR5App	10.115	2.696	10.069	2.915	.046	.016
10 HR6Div	10.18	2.670	10.175	2.664	.005	.001
11 HR7Comm	10.100	2.943	10.040	2.898	.060	.020
12 HRTOTAL	71.366	15.363	71.039	16.194	.327	.020
13 CEAIF1	12.837	3.023	12.609	3.007	.228	.075
14 CEAIF2	13.671	3.433	13.445	3.379	.226	.066
15 CEAIF3	13.397	3.148	13.322	3.053	.075	.024
16 CEAIF4	11.183	3.000	11.039	3.105	.144	.047
17 CEAIF5	14.98	2.505	14.981	2.724	-.001	-.001
18 CEAITOTAL	66.069	9.320	65.398	9.175	.671	.072

Note: IWB=Innovative Work Behaviour; LSTForm=Transformational Leadership; LSTSact=Transactional Leadership; LSLFair=Laissez-faire Leadership, HRG1T&D=Training and Development; HRG2Rem=Remuneration; HRG3Pm=Performance Management; HRG4Sup=Supervisor Support; HR5App=Staffing; HR6Div=Diversity Management; HR7Comm=Communication; CEAIF1=Management Support; CEAIF2=Work Discretion or Autonomy; CEAIF3=Rewards and Reinforcement; CEAIF4=Time Availability; CEAIF5=Organisational Boundaries

The most significant difference in mean scores was found at IWB, with a mean difference of 2.631 ($t(3141)=5.572$, $p<.001$) in favour of men, which represents 20% of one standard deviation (Cohen d=.200). Mean differences were also found at CEAIF1, with a mean difference of .228 ($t(3141)=2.108$, $p=.035$), which represents 7.5% of one standard deviation (Cohen d=.075). Lastly, a significant mean difference was found at CEAITOTAL, with a mean difference of .671 ($t(3141)=2.017$, $p=.044$), representing a 7.2% difference between mean

scores (Cohen d=.072). In all the mentioned cases, men achieved higher scores than women.

It can be noted that, in three cases, mean differences between men and women were significant. As these measures showed measurement across gender, these differences could be seen as actual differences in the levels on which men and women perceive the prevalence of the specified constructs.

Reliability

The Cronbach alpha reliability coefficients for IWB were .94 for men and .95 for women. With LSTForm they were .94 and .95, for LSRSact .82 and .83, and for LSLFair they were .53 and .57, listing the figure for the men first and then for the women. For HRTOTAL, the coefficients were .92 and .93 and for CEAITOTAL they were .76 and .75. The reliability coefficients for the men and the women were very similar, and, with the exception of CEAITOTAL, marginally better for women.

Correlation coefficients

Table 2 presents the correlation between the independent variables and IWB, behaviour per gender, differences in the size of these correlations, and the Z-observed scores, which were used to assess if these differences were practically significant. Table 2 follows on the next page.

Table 2

The correlation between various variables and innovative work behaviour

	Men N=1773	Women N=1370	Difference in r	Z-observed
Leadership Style				
LSTForm	.262**	.236**	.026	.722
LSTSact	.257**	.259**	-.002	-.055
LSLFair	.066**	.100**	-.034	-.944
PRM Practices				
HRG1T&D	.281**	.224**	.057	1.583
HRG2Rem	.244**	.240**	.004	.111
HRG3Pm	.270**	.216**	.054	1.499
HRG4Sup	.239**	.207**	.032	.888
HR5App	.293**	.246**	.047	1.305
HR6Div	.253**	.216**	.037	1.027
HR7Comm	.279**	.225**	.054	1.499
Innovation Climate				
CEAIF1	.255**	.200**	.055	1.527
CEAIF2	.208**	.189**	.019	.527
CEAIF3	.209**	.233**	-.024	-.666
CEAIF4	.035	-.012	.047	1.305
CEAIF5	.168**	.159**	.009	.249
Complex Model				
LSTForm	.262**	.236**	.026	.722
LSTSact	.257**	.259**	-.002	-.055
LSLFair	.066**	.100**	-.034	-.944
HRTOTAL	.349**	.296**	.053	1.471
CEAITOTAL	.288**	.256**	.032	.888

** Correlation is significant at the .01 level (2-tailed)

Note: LSTForm=Transformational Leadership; LSTSact=Transactional Leadership; LSLFair=Laissez-faire Leadership, HRG1T&D=Training and Development; HRG2Rem=Remuneration; HRG3Pm=Performance Management; HRG4Sup=Supervisor Support; HR5App=Staffing; HR6Div=Diversity Management; HR7Comm=Communication; CEAIF1=Management Support; CEAIF2=Work Discretion or Autonomy; CEAIF3=Rewards and Reinforcement; CEAIF4=Time Availability; CEAIF5=Organisational Boundaries

From the table above, it can be observed that, with the exception of CEAIF4, all the variables correlated significantly with IWB, irrespective of gender. When considering the Z-observed scores, not one exceeded the (+/-) 1.64 cut-off, indicating that the correlations between the individual variables and IWB did not differ significantly along gender lines.

Regression analyses

The results of regression analyses with IWB as outcome, per gender, are reported in Table 3.

Table 3

Regression analyses with innovative work behaviour as outcome

	Men			Women		
Leadership Style	R^2=.074; F(3, 1769)=48.17, p<.001			R^2=.066; F(3, 1366)=33.14, p<.001		
	Std. Beta	t	p	Std. Beta	t	p
Constant	-	45.647	<.001	-	39.238	<.001
LSTForm	.170	3.905	<.001	.049	.934	.350
LSTSact	.136	3.112	.002	.224	4.216	<.001
LSLFair	-.056	-2.241	.025	-.017	-.591	.554
HRM Practices	R^2=.124; F(7, 1765)=36.93, p<.001			R^2=.087; F(7, 1362)=19.71, p<.001		
	Std. Beta	t	p	Std. Beta	t	p
Constant	-	22.519	<.001	-	19.188	<.001
HRG1T&D	.127	4.622	<.001	.093	2.986	.003
HRG2Rem	.035	1.171	.242	.094	2.548	.011
HRG3Pm	.028	.800	.424	-.014	-.353	.724
HRG4Sup	.042	1.472	.141	.062	1.929	.054
HR5App	.128	4.289	<.001	.101	2.862	.004
HR6Div	.029	.965	.335	.026	.721	.471
HR7Comm	.075	2.304	.021	.036	.958	.338
Innovation Climate	R^2=.096; F(5, 1767)=38.84, p<.001			R^2=.084; F(5, 1364)=26.09, p<.001		
	Std. Beta	t	p	Std. Beta	t	p
Constant	-	12.824	<.001	-	11.413	<.001
CEAIF1	.164	6.353	<.001	.106	3.692	<.001
CEAIF2	.123	5.113	<.001	.105	3.772	<.001
CEAIF3	.091	3.587	<.001	.148	5.033	<.001
CEAIF4	-.021	-.930	.352	-.049	-1.890	.059
CEAIF5	.078	3.272	.001	.071	2.556	.011
Complex Model	R^2=.142; F(5, 1767)=58.44, p<.001			R^2=.111; F(5, 1364)=34.07, p<.001		
	Std. Beta	t	p	Std. Beta	t	p
Constant	-	12.132	<.001	-	10.553	<.001
LSTForm	.085	2.001	.046	-.007	-.128	.898
LSTSact	.018	.426	.670	.126	2.363	.018
LSLFair	-.045	-1.859	.063	-.017	-.610	.542
HRTOTAL	.234	8.084	<.001	.182	5.729	<.001
CEAITOTAL	.125	4.655	<.001	.109	3.427	.001

Note: LSTForm=Transformational Leadership; LSTSact=Transactional Leadership; LSLFair=Laissez-faire Leadership, HRG1T&D=Training and Development; HRG2Rem=Remuneration; HRG3Pm=Performance Management; HRG4Sup=Supervisor Support; HR5App=Staffing; HR6Div=Diversity Management; HR7Comm=Communication; CEAIF1=Management Support; CEAIF2=Work Discretion or Autonomy; CEAIF3=Rewards and Reinforcement; CEAIF4=Time Availability; CEAIF5=Organisational Boundaries

From the table, it is evident that, in all cases, the model fit was numerically better for men than women, as reflected in the R^2–values, which were larger for men than for women. The largest difference between R^2–values was found with HRM practices (R^2_{Men}=.124; R^2_{Women}=.087; $R^2_{Difference}$=.037). HRM Practices thus predicted 3.7% more of the variance in IWB for men than for women. The model fit of the Complex model, where the leadership styles, and the total scores for HRM practices and innovation climate were included, was also significantly better for men (R^2_{Men}=.142; R^2_{Women}=.111; $R^2_{Difference}$=.031). In the Complex predicting 3.i% more of the variance in IWB was explained for men than for women. Should we use the criteria set by Mackinnon (2010) for fit improvement (ΔR^2>.02; thus more than a 2% change), it should be assumed that these models fit men better than they do women.

Considering the subcomponents of the different models, and thus the significant beta values in Table 3, it is very interesting to note that transformational leadership was the primary driver for innovation for men, while it was transactional leadership for women. With HRM practices, the same subcomponents predicted IWB specifically and uniquely. Considering innovation climate, the subcomponents had similar values, with CEAIF5 being the exception, where it contributed uniquely to the variance for men, but not for women. Lastly, in the Complex Model, the predictors operated similarly across gender lines.

Moderation analyses

Models to demonstrate the effects of gender on the antecedents-IWB relationship are presented in Table 4. The models without gender or moderation tests are presented first, followed by the model including gender and the moderation model is presented last. See Table 4 on the next page.

Table 4
Regression analyses with innovative work behaviour as outcome

	Model without gender/moderation			Model with gender			Model with gender/moderation		
Leadership Style	R^2=.068; F(3, 3176)=78.27, p<.001			R^2=.079; F(4, 3142)=68.18, p<.001 **ΔR^2=.011**			R^2=.079; F(7, 3135)=39.60, p<.001 **ΔR^2<.001**		
	Std. Beta	t	p	Std. Beta	t	p	Std. Beta	t	p
Constant	-	60.530	<.001	-	59.937	<.001	-	45.478	<.001
LSTForm	.107	3.212	.001	.117	3.524	<.001	.172	3.890	<.001
LSTSact	.180	5.363	<.001	.172	5.113	<.001	.138	3.100	.002
LSLFair	-.042	-2.212	.027	-.038	-2.016	.044	-.057	-2.233	.026
Gender	-	-	-	-.096	-5.594	<.001	-.085	-1.519	.129
LSTForm X Gender	-	-	-	-	-	-	-.183	-1.848	.065
LSTSact X Gender	-	-	-	-	-	-	.111	1.162	.245
LSLFair X Gender	-	-	-	-	-	-	.060	1.070	.285
HRM Practices	R^2=.106; F(7, 3171)=55.11, p<.001			R^2=.117; F(8, 3142)=68.18, p<.001 **ΔR^2=.011**			R^2=.117; F(15,3127)=28.68, p<.001 **ΔR^2<.001**		
	Std. Beta	t	p	Std. Beta	t	p	Std. Beta	t	p
Constant	-	29.624	<.001	-	30.022	<.001	-	22.274	<.001
HRG1T&D	.110	5.369	<.001	.113	5.524	<.001	.123	4.572	<.001
HRG2Rem	.056	2.420	.016	.057	2.463	.014	.035	1.159	.247
HRG3Pm	.012	.473	.636	.011	.420	.674	.028	.791	.429
HRG4Sup	.050	2.367	.018	.051	2.394	.017	.042	1.456	.146
HR5App	.115	5.043	<.001	.116	5.113	<.001	.126	4.242	<.001
HR6Div	.028	1.221	.222	.028	1.197	.232	.029	.954	.340
HR7Comm	.061	2.486	.013	.059	2.391	.017	.074	2.279	.023
Gender	-	-	-	-.095	-5.672	<.001	.026	.311	.756
HRG1T&D X Gender	-	-	-	-	-	-	-.053	-.651	.515
HRG2Rem X Gender	-	-	-	-	-	-	.091	1.227	.220
HRG3Pm X Gender	-	-	-	-	-	-	-.079	-.791	.429
HRG4Sup X Gender	-	-	-	-	-	-	.035	.433	.665
HR5App X Gender	-	-	-	-	-	-	-.046	-.499	.618
HR6Div X Gender	-	-	-	-	-	-	-.006	-.065	.948
HR7Comm X Gender	-	-	-	-	-	-	-.068	-.747	.455

Table 4 (Continue)

Regression analyses with innovative work behaviour as outcome

Innovation Climate	R^2=.095; F(5, 3174)=11.58, p<.001			R^2=.100; F(6, 3142)=59.01, p<.001 **ΔR^2=.005**			R^2=.100; F(11, 3131)=32.60, p<.001 **ΔR^2<.001**		
	Std. Beta	t	p	Std. Beta	t	p	Std. Beta	t	p
Constant	-	17.295	<.001	-	17.572	<.001	-	12.763	<.001
CEAIF1	.139	7.282	<.001	.137	7.205	<.001	.163	6.323	<.001
CEAIF2	.121	6.661	<.001	.115	6.329	<.001	.122	5.089	<.001
CEAIF3	.117	6.135	<.001	.115	6.040	<.001	.090	3.570	<.001
CEAIF4	-.035	-2.027	.043	-.033	-1.951	.051	-.022	-.926	.355
CEAIF5	.073	4.062	<.001	.077	4.316	<.001	.079	3.256	.001
Gender	-	-	-	-.089	-5.277	<.001	.011	.085	.932
CEAIF1 X Gender	-	-	-	-	-	-	-.123	-1.476	.140
CEAIF2 X Gender	-	-	-	-	-	-	-.034	-.445	.656
CEAIF3 X Gender	-	-	-	-	-	-	.134	1.555	.120
CEAIF4 X Gender	-	-	-	-	-	-	-.051	-.777	.437
CEAIF5 X Gender	-	-	-	-	-	-	-.031	-.294	.769
Complex Model	R^2=.125; F(5, 3174)=91.52, p<.001			R^2=.134; F(6, 3142)=81.93, p<.001 **ΔR^2=.009**			R^2=.134; F(11, 3131)=45.15, p<.001 **ΔR^2<.001**		
	Std. Beta	t	p	Std. Beta	t	p	Std. Beta	t	p
Constant	-	15.885	<.001	-	16.494	<.001	-	12.014	<.001
LSTForm	.035	1.086	.278	.047	1.428	.154	.086	1.982	.048
LSTSact	.069	2.077	.038	.063	1.883	.060	.019	.422	.673
LSLFair	-.035	-1.878	.061	-.032	-1.761	.078	-.046	-1.841	.066
HRTOTAL	.207	9.758	<.001	.211	9.902	<.001	.232	8.006	<.001
CEAITOTAL	.128	6.285	<.001	.118	5.800	<.001	.124	4.609	<.001
Gender	-	-	-	-.091	-5.453	<.001	.026	.211	.833
LSTForm X Gender	-	-	-	-	-	-	-.136	-1.402	.161
LSTSact X Gender	-	-	-	-	-	-	.146	1.527	.127
LSLFair X Gender	-	-	-	-	-	-	.043	.785	.433
HRTOTAL X Gender	-	-	-	-	-	-	-.117	-1.139	.255
CEAITOTAL X Gender	-	-	-	-	-	-	-.051	-.345	.730

Most important in interpreting the findings in Table 4 are the changes in the effectiveness of the different models, as reflected in ΔR^2. Mackinnon (2010) suggests that an improved fit occurs when $\Delta R^2 > .02$. This did not occur with any of the models which introduced gender. Given this criterion, gender is not a moderator in any of the antecedent-IWB relationships.

Also important in interpreting the findings in Table 4 are significant beta values for gender in Model 2, as well as gender or the interaction terms in Model 3. It can be observed that in all Model 2 cases, gender was a significant predictor of IWB, suggesting that gender is a predictor of IWB, thus an antecedent and not a moderator. Considering Model 3, none of the interaction terms' beta values were significant, indicating that moderation does not occur.

Discussion

In this study, the relationship between antecedents to innovation and IWB was assessed across gender. In the literature reviewed, many examples empirically linking these antecedents with IWB were found, however instances of evidence of gender having a differential effect on the relationships are few. This study makes a significant contribution to the body of knowledge regarding the antecedents of IWB and gender, as it presents relational comparisons that are empirically sound, using only measures in which measurement invariance across gender was demonstrated prior to the analyses. In structural equation modelling terms, relations or paths were only tested once the measurement models were proven to be sound. Eliminating such bias before engaging in testing relationships is an aspect not often implemented and represents the primary contribution of this study.

The sample for this study was adequate for the analyses performed, presenting similar numbers of men and women, and resembling the employment statistics reported in the Quarterly Labour Force Survey (Statistics South Africa, 2019). The relatively large sample size necessitated the use of practical significance as indicator, as statistical significance often leads to unwarranted conclusions when using large samples (see Lin, Lucas, & Shmueli, 2013).

Of the seven instruments administered, only four were MI across gender. Often-used instruments such as the UWES-9 (Schaufeli et al., 2006) and OCS (Allen & Meyer, 1990) were

eliminated from the study, given the non-invariance across gender. At the end, only the MLQ (Avolio et al., 1995, 1999), HRPS (Nyawose, 2009; Steyn, 2012), BCEAI (Hornsby et al., 2002; Strydom, 2013), and the IWB (Kleysen & Street, 2001) were included in the study, as these instruments were MI across gender.

Mean scores and mean score differences across gender were calculated. As these measurements were measurement invariant, the reported differences would present substantive differences (Bialosiewicz, Murphy, & Berry, 2013; Vandenberg & Lance, 2000) between men and women. Practically significant differences were detected in only three of the 18 mean scores calculated. The largest of these presented 1/5 of a standard deviation and related to IWB (see IWB in Table 1). As the IWB measure is invariant, it can be reported that men do report higher levels of innovative work behaviour. Men also experience more management support (see CEAIF1 in Table 1) and, in general, a more conducive environment to being innovative (see CEAIFTOTAL in Table 1). This may be an important finding, should the only difference be the perceived overall climate in the organisation and the level of managerial support men experience. Also important in this context is that on 15 of the 18 means reported, men and women did not differ in their reporting. Men and women thus experience the workplace in a very similar manner.

How the relationships between antecedents and IWB differed along gender lines was central to this research, rather than the mean differences between the genders. Data were thus primarily collected and analysed to answer questions such as the following: Does transformational leadership (a leadership style) influence innovative behaviour differently for men than it does for women?", "Does training and development (an HRM practice) influence innovative behaviour differently for men than it does for women?", and "Does work discretion and autonomy (a climate for innovation element) influence innovative behaviour differently for men than it does for women?"

Considering the most simple models (correlations), no gender differences were found in any of the 17 models tested. Thus, all three leadership styles, all seven HRM practices, and all five climate variables related similarly to IWB across gender (see Table 2). When using measurement invariant measures, the relationships between the variables were similar. It is interesting to note that being exposed to transformational leadership correlated the strongest with IWB for men, while in the case of women the strongest correlation was with

being exposed to transactional leadership. This finding is remarkable as research focusing on men and women's leadership styles indicates that men tend to be more transactional and women more transformational (Eagly et al., 2003; Xu et al., 2016). It would thus be fascinating to find out if men in leadership roles evoke IWB in women, and vice versa.

With regards to HRM practices, the fair management of the recruitment process (see HR5App in Table 2) related most strongly with IWB for both men and women. Considering climate, management support related strongly with IWB for men (see CEAIF1 in Table 2), and rewards and reinforcement for women (see CEAIF3 in Table 2). This finding regarding rewards and reinforcement (CEAIF3) and transactional leadership (for women), and management support (CEAIF3) and transformational leadership (for men), could be interpreted as complementing each other, given the nature of the different leadership styles.

The more complex regression models are presented in Table 3. In the leadership style model, and complementing the finding regarding the correlations, transactional leadership played a unique role in predicting IWB amongst women. With men, on the other hand, transformational leadership, and to a lesser extent transactional leadership, drove IWB. Training and Development (see HRG2T&D), and fair management of the recruitment process (HR5App), contributed significantly and uniquely to IWB for both men and women. With regard to climate, the same variables were drivers of IWB, with the exception of organisational boundaries (CEAIF5), which was important to men only. Considering the complex model, HRM practices and climate, more than leadership styles, seem to be unique predictors of IWB. This model was also most predictive (R^2_{Men}=.142; R^2_{Women}=.111; $R^2_{Difference}$=.031), accounting for 14.2% and 11.1% of the variance in IWB.

In all the cases, the predictive power of the models (R^2) was larger for men. Others (see Sánchez-Escobedo et al., 2014) report the same tendency in a similar setting, reporting that the explanatory power of models linking gender and innovation (entrepreneurial intentions) are more conclusive for men than for women.

Lastly, testing for moderation was performed (see Table 4). In this analysis, the focus is primarily on how the models improve (ΔR^2), given the introduction of gender and gender-interaction as variables. As can be observed from Table 4, the introduction of gender improved the models by 1.1% (for the first two models), by .5% for the next model, and by .9% for the last model. When gender-interaction was added (Model 2, the moderation

model), the models improved by less than .1%. Given this, it may be concluded that gender does not moderate any of these relationships. The picture is, however, a little more complex than this would suggest. In the second model, in which (only) gender is added to the regression, gender contributes uniquely and significantly to the variance in IWB. This indicates that gender is not a moderator, as suggested, but rather a predictor of IWB, and thus an antecedent to IWB.

Practical and managerial implications

The findings presented here demonstrate that leadership style, but to a larger extend HRM practices and a climate for innovation, are antecedents to IWB. Managers should thus be aware of the significant role that these antecedents play: Transactional leadership and rewards and reinforcement, for women; and transformational and management support for men. With regard to HRM practices, the fair management of the recruitment process was important to both men and women, in relation to IWB.

These antecedents contributed 12.5% to the variance in IWB, suggesting that other factors substantially influence IWB. Aspects such as the proactive personality (Bateman & Crant, 1993) play an important role, as Steyn (2019) reports that 23.9% of the variance in IWB is explained by this individual characteristic. This points to the importance of selecting the correct individuals with the appropriate traits, as echoed in the present research, where men and women endorsed the importance of fair management of the recruitment process as being linked to IWB in organisations.

The role of gender in IWB was central to this study. It could be reported that although gender, statistically, seems to be a predictor of IWB, the effect of gender in practice is negligible. Gender explains about 1% of the variance in IWB. It would, therefore, be acceptable to concur with Kvidal and Ljunggren (2014) that gender is a non-issue in terms of innovation.

Contribution

This article contributes significantly to the body of knowledge regarding gender in the workplace, suggesting that at an individual employee level, men and women respond similarly to organisational variables (when the measures are invariant). This seems to be at odds with the notion that gender diversity contributes to innovation in teams and also suggests that the dynamics which drive innovation in groups differ from those where the focus is on the individual employee.

Limitations and suggestions for future research

Some reviewers may judge the absence of structural equation modelling in this research as a limitation. While future researchers may choose to take that route, regression modelling was applied in this instance as the authors are of the opinion that the technique is more explicit in detailing the moderation effects.

The complexity of the research was limited because of the mediator variables (engagement; Schaufeli et al. (2006) and organisational commitment; Allen and Meyer (1990)) were eliminated because they were not measurement invariant across gender. Future researchers are advised to include more such variables when collecting data, both so as to avoid this predicament, and to enable them to test more complex models.

In line with the present custom in South Africa in most formal organisational settings, this research report refers to its respondents as (self-identified) men and women. Contemporary gender identification, however, is more fluid than this might suggest and identification as lesbian, gay, bisexual or transgender (LGBT) can have substantive consequences in the workplace (see Badgett, Lau, Sears, & Ho, 2007; Grant, Mottet, Tanis, Harrison, Herman, & Keisling, 2011), a factor which may also influence the relationship between innovation and its antecedents. Researchers are encouraged to engage in this complex matter.

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CHAPTER 7: SUMMARY AND CONCLUSION

In this chapter, a general summary of the thesis will be provided. It will be followed by concluding remarks, focusing on the attainment of the research objectives and the reasons why the research was originally embarked upon. After presenting the limitations of the study, recommendations will be volunteered.

7.1 Summation

This thesis is comprised of an introductory chapter, where the aims of the research are specified, as well as five articles. The results are summarised in the paragraphs that follow. An integrated summary of the results is provided, going beyond what is reported in the separate articles and serving to link them.

Article 1: Investigating the validity of the Human Resource Practices Scale in South Africa: Measurement invariance across gender. In this study it was found that, given the sample used, the Human Resource Practices Scale (Nyawose, 2009) was measurement invariant with regard to gender at a configural, weak, strong, and strict invariance level, and also that the latent means for men and women on the five factors were equivalent. These results indicate to researchers and practitioners that the Human Resource Practices Scale can be used with confidence amongst men and women, and that mean differences found while using the instrument are a reflection of employees' standing on the measured construct, and not a consequence of their gender. Also important to note was that, in this sample, the latent means of the men and the women were equivalent, which indicates that they perceive the human resource functions they are exposed to as being at the same level.

Article 2: The structural validity and measurement invariance across gender of the Brief Corporate Entrepreneurship Assessment Instrument. The Brief Corporate Entrepreneurship Assessment Instrument (Hornsby, Kuratko, & Zahra, 2002; Strydom, 2013) also exhibited measurement invariance with regard to gender at a configural, weak, strong, and strict invariance level. The latent means of men and women, on the theorised five factors, were equivalent. The assured use of the instrument when comparing men and women is therefore possible and, given these characteristics, the Brief Corporate Entrepreneurship Assessment

Instrument was also included in further stages of the overarching study. The climate for innovation that these individuals are exposed to is therefore perceived to be similar, and not gender-specific.

Article 3: The structural validity of the Innovative Work Behaviour Questionnaire: Comparing competing factorial models. Contrary to what had previously been found, the Kleysen and Street measure of innovative work behaviour (2001) displayed the five theorised factors proposed by the designers, which the developers could not replicate with their empirical study (see Kleysen & Street, 2001). This affirmed the (factorial) validity of the instrument in this sample and, as such, it was considered for inclusion in the later stages of the over-arching study.

Article 4: Gender-based differences in the manner individual and organisational constructs are measured: A test of measurement invariance. In this article, all the proposed variables of the structural model of the study were jointly tested for measurement invariance. All the independent variables (see X in Figure 2 below), namely the previously tested Human Resource Practices Scale (Nyawose, 2009), the Brief Corporate Entrepreneurship Assessment Instrument (Hornsby et al., 2002; Strydom, 2013), and the newly tested Multifactor Leadership Questionnaire (Avolio, Bass, & Jung, 1995), were measurement invariant across gender at a configural, weak, strong, and strict invariance level. The latent means were also comparable. With respect to the mediators, the Utrecht Work Engagement Scale-9 (Schaufeli & Bakker, 2003; Schaufeli, Bakker, & Salanova, 2006; see EE in Figure 2) and the Organizational Commitment Scale (Allen & Meyer, 1990; see AOC in Figure 2) both failed to meet measurement invariance at the configural level – the lowest level where the same items did not load on the same factors, as per gender. The same unsatisfactory result was also discovered in the case of the moderator variable, namely the Proactive Personality Scale (Bateman & Crant, 1993; see PPS in Figure 2), which also failed to demonstrate measurement invariance at configural level. It therefore seemed as if the independent variables, of which the content is related to employees' perceptions of their work environment, were measurement invariant, whilst the moderator and mediator variables, related to personal attitudes and attributes, were non-invariant. Fortunately for the continuance of the research project, the dependent variable, which reports on the employees' behaviour, namely the

Innovative Work Behaviour Questionnaire (Kleysen & Street, 2001), was measurement invariant from configural through to latent mean level.

At least two important issues for consideration were highlighted by this article: Firstly, that instruments are not by default measurement invariant across different groups, and that testing for measurement invariance is important. It was interesting to note that instruments were fully invariant or completely non-invariant. Secondly, measurement invariance may be specific to certain measurement domains. Although too few instruments were tested for measurement invariance in order to make substantiated recommendations regarding the types of the instruments susceptible to measurement invariance, this research may at least contribute to the development of working hypotheses on domains where measurement invariance could be prevalent.

The negative results reported in Article 4 (Chapter 5), these being that three of the seven instruments tested were non-invariant, simplified and reduced the complexity of the prediction model which could be securely analysed. Both the mediator variables and the moderator variable, originally included in the complex model, needed to be unjustified, as it would be irresponsible to use instruments which are measurement non-invariant.

With regard to mean differences, significant discrepancies across gender were found only on the Innovative Work Behaviour Questionnaire (Kleysen & Street, 2001), and not at any of the independent variable levels. This is reported on in Article 5 (Chapter 6). It was found that men and women perceive the levels of the independent variables very similarly, with no practically significant mean score differences. However, with regard to Innovative Work Behaviour (the dependent variable), men scored higher than women.

Article 5: Gender differences in the relationship between innovation and its antecedent.

Here, the model used for testing the relationship between innovation and its antecedents, taking gender into account, was tested and the results thereof presented. The scope of the proposed investigation (see Figure 1) shrank quite considerably, given the variables excluded based on their non-invariance. The final model tested is presented in Figure 2. In this diagram the grey lines indicate the elements removed from the model.

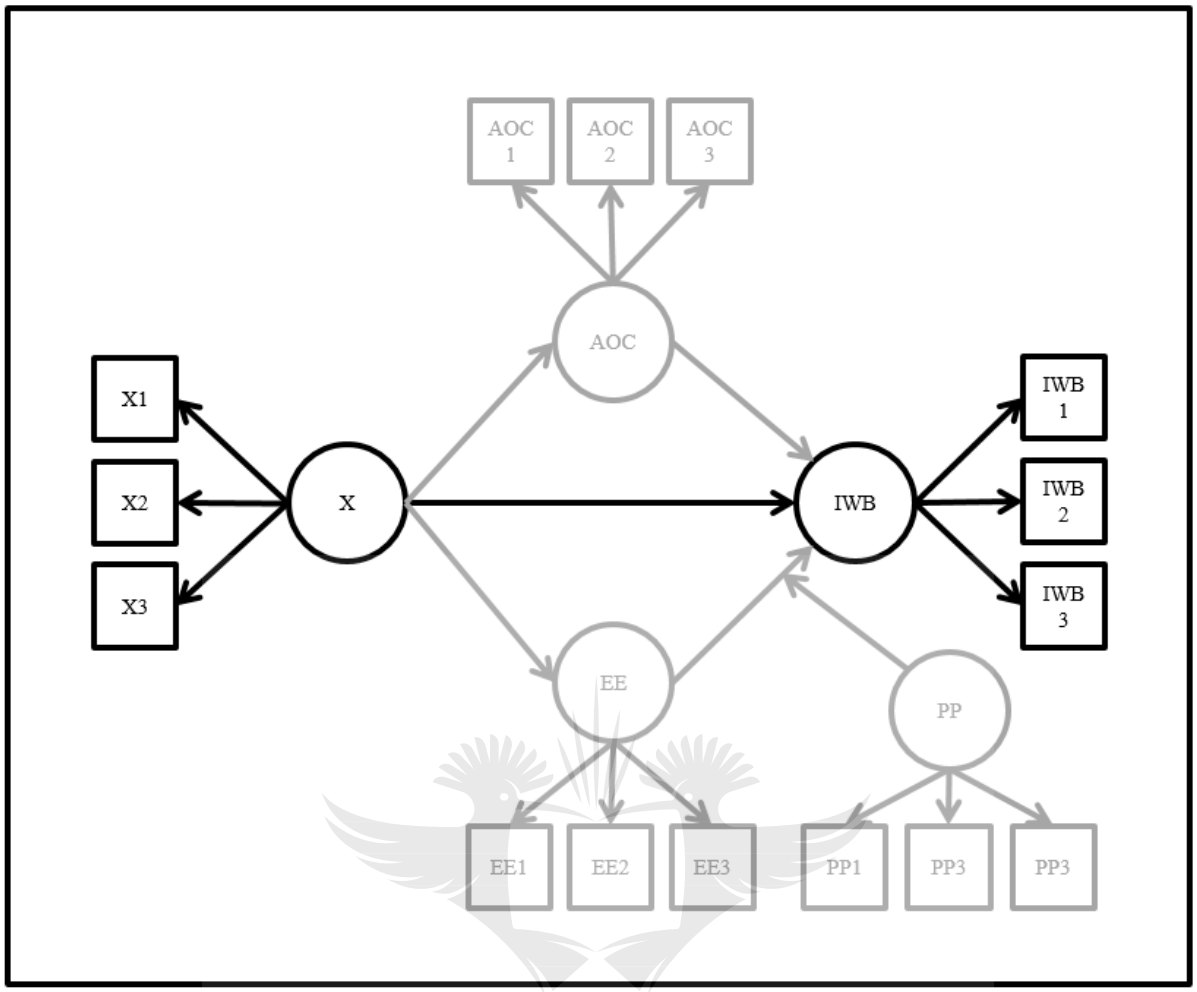

Figure 2. Antecedents to innovative work behaviour – tested model. X represents all the independent variables, namely the Human Resource Practices Scale (Nyawose, 2009), the Brief Corporate Entrepreneurship Assessment Instrument (Hornsby et al., 2002; Strydom (2013), and the Multifactor Leadership Questionnaire (Avolio et al., 1995); EE represents the Utrecht Work Engagement Scale-9 (Schaufeli & Bakker, 2003; Schaufeli et al., 2006); OC represents the Organizational Commitment Scale (Allen & Meyer, 1990); PP represents the Proactive Personality Scale (Bateman & Crant, 1993); and IWB represents the Innovative Work Behaviour Questionnaire (Kleysen & Street, 2001). The grey areas represent areas from the original model which were removed, given that the measures were non-invariant across gender.

No differences were found in the way the independent variables correlated individually with IWB. No significant differences in the correlations between antecedents of IWB and IWB

were found. In this simple model, antecedents had the same effect on IWB, irrespective of gender.

When performing regression analyses (combining the subscales of the independent variables to predict innovative work behaviour), each of the following significantly influences innovative work behaviour, irrespective of gender: human resource practices (to the largest extent), followed by innovative climate and, with the lowest level of influence, leadership styles. This is an important finding, as what has been learnt here could influence the selection of interventions aimed at enhancing innovation.

The models explained more variance in IWB in the case of men, compared to women. Such a finding of better explanatory models for men also appeared in previous studies (Sánchez-Escobedo, Díaz-Casero, Díaz-Aunión, & Hernández-Mogollón, 2014).

When testing for the moderating effect of gender in the independent variable-IWB relationship, no such effects were found. Instead, the analyses revealed that gender acted as a direct predictor of IWB. Gender was therefore an independent variable. The higher score of men on IWB is a direct result of gender, implying that men (report) higher levels of IWB, irrespective of the independent variables included in the model. This result may be interpreted as systematic bias, related to the IWB instrument, but this is not the case, as the test of measurement invariance across gender indicated that the mean latent means are comparable. This result has serious consequences for recruitment and development at an organisational level, but also raises important philosophical questions, legitimate within the empirical feminist domain.

These findings also have important methodological consequences. These will be alluded to later. For now, it will suffice to state that the model presented in Figure 1 could have been tested across gender had measurement invariance not been tested for. By testing a model which includes only measurement invariant instruments, a less complex, and also less descriptive, model was tested, which restricts the explanatory value of the model. However, a more sound model (Figure 2) was also tested, which is theoretically and empirically much more defensible.

7.2 Attainment of research objectives

Four empirical research objectives were set for this study:

1. To empirically investigate the extent to which women and men attach the same meaning to a selection of antecedents to innovative behaviour. It was found that the independent variables, the variables about how employees perceive their workplaces (as measured with the Corporate Entrepreneurship Assessment Instrument (Hornsby et al., 2002), the Human Resource Practices Scale (Nyawose, 2009), and the Multifactor Leadership Questionnaire (Avolio et al., 1995)), were psychometrically equivalent across gender. Men and women therefore attached the same meaning to the phenomena they observed in the workplace.

However, men and women did not attach the same meaning with respect to their own workplace attitudes (as measured with the Organizational Commitment Scale (Allen & Meyer, 1990) and the Utrecht Work Engagement Scale-9 (Schaufeli & Bakker, 2003; Schaufeli et al., 2006)). This was also found in the case of the only attribute tested, where the results of the measurement invariance testing revealed that the Proactive Personality Scale (Bateman & Crant, 1993) was non-invariant across gender. These results suggest that, when inward-looking, men and women do not attach the same meaning to their attitudes and attributes.

The Innovative Work Behaviour Questionnaire (Kleysen & Street, 2001) was measurement invariant across gender, with men and women attaching the same meaning to the phenomenon of innovative work behaviour. It could be speculated that reflections on innovative work behaviour are less "inward-looking" than reflections on attitudes and attributes of the workplace, but this interpretation, and the elementary categorisation of measurement invariant and non-invariant instruments presented above, should be seen as tentative.

It could be concluded that the empirical investigation on the extent to which women and men attach the same meaning to a selection of antecedents to innovative behaviour, revealed that, in the case of some variables (those that perhaps require higher levels of introspection), men and women differ in the way they conceptualise such concepts. Perhaps most importantly, it can be concluded that some instruments, that were proved to be

measurement non-invariant, necessitate the need to test for measurement invariance when conducting responsible research.

2. To empirically investigate the extent to which the measures of innovation in the workplace reflect the design intentions of Kleysen and Street (2001). The five-factor structure of the IWB originally proposed by Kleysen and Street (2001) was supported by the data. This is a significant result, as Kleysen and Street (2001) were not able to confirm their theorising with the data they collected in their study (n=225). In the present study, with a sample of 3 180 participants, the "relatively poor fit between the hypothesised factor structure and respondents' job behaviors" (Kleysen & Street, 2001, p. 284) was not replicated, which may highlight potential methodological issues in the Kleysen and Street study. Whereas it is not uncommon to conduct structural equation modelling studies with samples as small as 150 participants, the threat remains that sampling error may cause point-estimates of coefficients (e.g. factor loadings, factor correlations and path coefficients) to substantially deviate from the population values, which in turn may lead to incorrect conclusions. In the present study, with a large sample (n=3 180) which yielded highly stable point-estimates of the factor loadings and factor correlations, support was found for the proposed factor structure of the IWB, whereas Kleysen and Street (2001) failed to do so with a relatively small sample (n=225). It is possible that Kleysen and Street's disappointing results may have reflected sampling error rather than a problem with the proposed measurement model.

3. To empirically investigate the extent to which the measure of innovation in the workplace displays measurement invariance with regard to gender. Results showed that the IWB was indeed measurement invariant across gender, at configural, metric, intercept, strict, and latent means level (see Article 4, Chapter 5). The empirical support for the measurement invariance of the IWB across genders indicates that the IWB may be fruitfully used in further research where gender and innovative work behaviour is involved.

4. To empirically investigate the effect of antecedents to innovation on innovative behaviour, from a gender perspective. More specifically, the objective here was to assess whether the relationship between antecedents of innovation (the independent variables) and innovation (the dependent variable) are similar for men and women (when using instruments which have psychometric equivalence with regard to gender). This objective was also achieved and is reported on in Article 5 (Chapter 6). Considering the predictive models for

men and women separately, human resource management practices predicted innovative work behaviour best, followed by innovation climate, and leadership styles, for both groups. Although the antecedents seemed to play similar roles across gender, the predictive models were marginally more descriptive for men than for women (see Table 3 in Article 5).

The prediction models that explicitly included gender as a moderator of the moderator of the relationship between the antecedents and the dependent variable (using the procedure described by Mackinnon (2010), similarly showed that human resource management practices predicted innovative work behaviour best, followed by innovation climate, and leadership styles. These results evidenced that gender had an influence as a main effect on innovative work behaviour, but not as a moderator. Hence, the relationship between the antecedents and innovative work behaviour was constant across men and women, but men consistently scored higher than women on innovative work behaviour, even if they had the same standing on the antecedents.

The main effect of gender raises questions about the source of the effect. Why is it that men scored higher on innovative work behaviour? Tentative answers to this question are given in the section where recommendations for further research are made.

Absent from the discussion above are references to previous research findings, the present research in relation to previous findings, and how the study builds on the present body of knowledge. As mentioned in Chapter 1, most research on gender focuses on gender diversity as the focal independent variable, and not on gender as a variable representing men and women as separate categories. In this respect, the existing body of knowledge regarding the role of gender in understanding innovative work behaviour is relatively small. A secondary reason for the relative scarceness of references is due to the fact that many research studies deal with women entrepreneurs (with entrepreneurship a proxy to innovative work behaviour and often the primary task of leaders; see Text Box 1 in Chapter 1), and not men and women performing innovative work behaviour (a distinct task variable, associated with discretional work behaviour, performed by ordinary employees within organisations). In this respect, the current study potentially contributes to the relatively small body of knowledge regarding gender and innovation. This contribution is unpacked in the paragraphs that follow.

7.3 Contribution of the study

The contribution made through this research is related to the motivation to conduct the research, presented in Chapter 1. Three motivations were provided for conducting this research.

The potential contribution of the current study needs to be evaluated with reference to the motivation to conduct the research, which was presented in Chapter 1. To recap, three principal motivations were the drivers of the current study.

The first motivation is that not enough is known about the role gender plays with regard to innovation (see Díaz-García, González-Moreno, & Sáez-Martínez, 2013; Nählinder, Tillmar, & Wigren, 2015). This is important given the contemporary and justified emphasis that is placed on achieving gender equality in the workplace and the changing gender demographic of many workplaces. Some contribution to the body of knowledge was made in this regard. Firstly, Articles 1, 2 and 4 cumulatively contribute to enlarging existing knowledge regarding the measurement invariance of instruments used to directly or indirectly study innovative work behaviour in South Africa, across gender. In these three articles, it is demonstrated that the basic way in which men and women perceive the workplace with respect to human resource practices and the workplace climate are very similar. In turn, this implies that these instruments may be fruitfully used in future studies without concern about gender bias. By contrast, however, when it comes to workplace attitudes and personal attributes (e.g. work engagement, proactive personality), the results showed that men and women differ qualitatively from each other. Put differently, men and women did not attach the same meaning to the content of the UWES-9 and the Proactive Personality Scale. this then raises the intriguing question of the nature and source of such differences.

Secondly, the interplay between antecedents of innovation, gender, and innovation was addressed. The results revealed that, for men and women, the same variables were central in predicted innovation. The order of these variables was also the same for the two groups. As a whole, the results showed that the antecedents were equally predictive of innovative work behaviour for men and women (i.e. gender did not have a moderating role). Results also showed, however, that gender plays an independent and significant role as a main effect in predicting innovative work behaviour, above and beyond the modelled antecedents. Men

showed higher levels of innovative behaviour in the workplace than women, after controlling for the antecedents. The sources of the observed difference remain unclear because of the complexity of gender as an independent variable. The gender variable carries along with it a multitude of other latent variables that were not modelled in the current study and that could explain the observed difference.

The second motivation was that there are conflicting views about existing knowledge on the importance of gender as a workplace variable. Some authors state that differences occur (see Francoeur, Labelle & Sinclair-Desgagné, 2008; Ruiz-Jiménez, Fuentes-Fuentes, & Ruiz-Arroyo, 2014), whilst others state that differences occur sometimes (see McMahon, 2010; Parrotta, Pozzoli, & Pytlikova, 2014). Some researchers regard gender differences as a non-issue (see Kvidal & Ljunggren, 2014; Sonfield, Lussier, Corman, & McKinney, 2001). This research substantially contributes to this debate. Firstly, this study reveals that the measurement of constructs, essential to the empirical processes, could be at the heart of these conflicting views. Conflicting results may be the result of using gender biased measures. In the case of this research, it was found that some very popular instruments within the industrial and organisational psychology domain failed to demonstrate measurement invariance across men and women, which is a potential cause of concern with respect to research and practice.

Secondly, the research revealed that analysing predictive models with appropriate assessment instruments (which proved to be measurement invariant) delivered two very specific results. Firstly, it was found that when organisational variables are measured with instruments that are measurement invariant across gender, the relationship between these variables remains similar across the gender spectrum. This refers to the angle of the regression line. Secondly, it was also found that although the relationships were similar, with the regression lines being parallel for men and women, men obtain higher scores than women on the measure of innovative work behaviour. The intercept of the regression line is therefore higher for men than for women. Such a finding may be interpreted as systematic bias, and could lead to assumptions that the IWB instrument unfairly discriminates against women. However, such an argument would be incorrect as, during testing of measurement invariance across gender, it was found that the IWB instrument is measurement invariant at the highest level, specifying that the latent means are comparable. This poses a very strong and precise

finding, one which could play a role in directing theorising on this topic. Using only instruments that are measurement invariant and recognising that men perform better on innovative work behaviour, irrespective of antecedents, should therefore lessen ambiguity and foster consistence with regard to the knowledge on the antecedents to innovative work behaviour.

The third motivation, focused on the use of improved methods to studying the role played by gender in innovative work behaviour. At a methodological level, this research makes a significant contribution, particularly regarding the conceptualisation (see Alsos, Ljunggren, & Hytti, 2013; Sánchez-Escobedo, Díaz-Casero, Díaz-Aunión, & Hernández-Mogollón, 2014), and the construct validity of measurement instruments (see Alsos, Ljunggren, and Hytti, 2013; Nählinder, Tillmar, & Wigren, 2015). With regard to conceptualisation as well as the validity of the measurement, the means previously used were outdated and the methods inadequate. With respect to the first element (conceptualisation), this research makes a contribution in defining the concept of innovative work behaviour comprehensively (see Article 3). The structure of the theoretical concept of innovative work behaviour, as originally defined and proposed by Kleysen and Street (2001), was supported.

Apart from empirically demonstrating support for the five factor structure, which was not achieved by Kleysen and Street (2001), the results of the current study also add weight – and potentially depth – to the meaning of the concept. In Article 3, the following information on the concept is articulated: "The results revealed that exploration and generativity occur more often than investigation, championing and application, alerting theorists to the dwindling effect of creative ideas and also to the hierarchical nature of the steps embedded in IWB. With regard to structure, the results revealed that the IWB steps were correlated, not orthogonal, and unlikely to be sequential as theorised. The initial steps of IWB (exploration and generativity) are therefore linked to the latter steps (investigation, championing and application), implying that employees are cognisant of the latter steps when engaging in the former". This specification and detailed description of the concept shed new light on this emergent concept, the use of which was, in the past, incapacitated by ambiguity regarding its structure and composition. Also, finding that the instrument yields psychometrically invariant scores across gender (see Article 4, Chapter 5) encourages the use of the construct and instrument in future research.

With regard to the second element (measurement), the current study makes a significant contribution related to the measurement of several organisational constructs (see Article 1, 2 & 3). In Article 1, the construct validity of the Human Resource Practices Scale (HRPS) (Nyawose, 2009; Steyn, 2012) was assessed, focusing on measurement invariance across gender. The "results support the construct validity of the HRPS and demonstrate strict measurement invariance for the HRPS across gender, which implies that the HRPS yields scores with equivalent meaning, measurement units and measurement precision for men and women" (Steyn & de Bruin, 2018, no page). In the case of Article 2, the structural validity and measurement invariance across gender of the Brief Corporate Entrepreneurship Assessment Instrument (BCEAI) (Hornsby, Kuratko, & Zahra 2002; Strydom, 2013) were tested. Here, the results reveal that the BCEAI mirrors the structure of the original instrument in the South African context and that the BCEAI yields psychometrically equivalent scores among employees of both genders. In Article 4, measurement invariance test results across several instruments, including those presented in Article 1 and 2, are presented. These measures are the previously mentioned HRPS (Nyawose, 2009; Steyn, 2012), the BCEAI (Hornsby, Kuratko, & Zahra, 2002; Strydom, 2013) and, additionally, the Multifactor Leadership Questionnaire (MLQ) (Avolio, Bass, & Jung, 1995, 1999), the Utrecht Work Engagement Scale (UWES-9) (Schaufeli & Bakker, 2003; Schaufeli et al., 2006), the Organisational Commitment Scale (OCS) (Allen & Meyer, 1990), Innovative Work Behaviour (IWB) (Kleysen & Street, 2001) and Individual Pro-Activeness (IPA) (Bateman & Crant, 1993). The results were mixed, with four of the instruments (HRPS, BCEAI, MLQ, & IWB) showing measurement invariance at an equal latent means level, whilst three instruments (UWES-9, OCS, & IPA) were non-invariant at the configural level. Measurement invariance was either accepted completely, or rejected completely. The serratedness of results, even when using well-recognised and often-used psychometric instruments (i.e. UWES-9 and OCS), underlines that measurement invariance is an empirical aspect that should not be automatically assumed. Through the use of modern data analytic techniques (i.e. multi-group confirmatory factor analysis), the research demonstrates that the existing knowledge base regarding gender differences in organisational behaviour, which was generated without an explicit focus on measurement invariance across men and women, is potentially misleading. In particular, whereas previous results suggested that male dominance in innovation is endemic to context (Alsos et al., 2013;

Blake & Hanson, 2005), tradition (Harrer & Lehner, 2018; Reddy, Sharma, & Jha, 2019), and a consequence of the research method (Nählinder et al., 2015; Wikhamn & Knights, 2013), the results of the current study (which explicitly took measurement invariance into account) suggest that this may be due to masculine attributes. While men and women perceive the concept of innovative behaviour similarly, men seem to consistently perform better than women on this dimension.

A major contribution of the study is its demonstration of the impact of assessing measurement invariance in modelling organisational behaviour. Referring back to the original proposed model describing the relationship between innovative work behaviour and its antecedents (Figure 1), and comparing that with the final model presented in Figure 2, serious concerns should be raised. Two employee attitudes (namely affective organisational commitment (AOC) and employee engagement (EE)) were not included as mediators in the models, and the employee attribute (proactive personality (PP)), as possible moderator of the employee engagement-innovative work behaviour link, was eliminated from the analyses, as they were not measurement invariant across gender. A much simpler model was therefore proposed and analysed. Had measurement invariance not been assessed, these variables would have been included in the analyses (irresponsibly), which could have yielded unjustified results. This stresses the importance of testing for measurement invariance, and of doing so before engaging in the modelling and collection of data on proposed models.

7.4 Limitations

Like all empirical studies, the current study is imperfect and several limitations can be identified. The researcher was aware of many of these constraints beforehand, and they were consequently specified in the delineation of the study. Some of these delineators are cited here again so as to guide future researchers, with more resources at their disposal, to improve on this study.

The first limitation relates to the use of the cross-sectional survey design in a predictive model. As cross-sectional studies are carried out at a specific point in time and offer no indication of the sequence of events, it is impossible to infer causality from such studies (Levin, 2006). Using an experimental or quasi-experimental design (Kerlinger & Lee, 2000)

would have been ideal, and future researchers are indeed encouraged to follow that route. However, given the statistical analyses which needed to be performed, the sample size dictated that, to perform these while remaining within budget constraints, a cross-sectional design was the only feasible route to follow.

The validity of the study may be limited by the problem of common method bias, a concern often raised with cross-sectional designs, where data on both the dependent and the independent variables are collected from single-source, typically using self-reporting as the only way of generating data (Podsakoff, MacKenzie, & Podsakoff, 2012). Following the guidelines of Jacobsen and Jensen (2015), and focusing on common method bias created by using the same respondents (or source) to report on the independent and the dependent variable, requesting respondents to report on diverse aspects may mitigate some of this bias. Respondents were asked to report on their workplace (including organisational climate, the leadership practices in the organisation), their individual attributes, attitudes and behaviour. Reporting on the self and on others seemingly reduces common method bias. Common method bias produced by item characteristics was alleviated in this study through the exclusion of questionnaires which included ambiguous, abstract or complex subject matter, and by the inclusion of instruments with items which were positively and negatively worded. Furthermore, the instruments included in the battery had different scale properties (e.g. 5 and 6-point scales), which also dampen the effects of common method bias. Considering this particular research, it may thus be concluded that common method bias was managed relatively well, particularly as reporting on one of the central variables, namely gender, seems relatively free from method bias. Jacobsen and Jensen (2015, p. 13) report, with reference to gender, that "common method bias seems less likely since the variable is generally easy for respondents to answer, and we would expect few people to lie about their gender"[10].

The way the recruitment of respondents for the study was managed limits the generalisation of the results. The data were mostly collected in organisations where students were employed – making it a convenient sample of organisations. This is not ideal in terms of generalisation. However, given that 52 different organisations, across diverse economic

[10] It may be open to question whether this statement of Jacobsen and Jensen (2015) is still valid in 2019, as gender fluency seems to have developed exponentially and has become a politicised concept.

sectors, were involved in the study, this limitation was somewhat reduced. Drawing a random sample of organisations would have been ideal, but obtaining access to these organisations and persuading the top managers and employees to participate in the study, without any substantial benefits available, was deemed as unfeasible. The relatively successful drawing of random samples within the organisations, which occurred in all 52 organisations, should positively contribute to the generalisation of the results.

The pooling of data across sectors is a limitation of the study. It may have been useful to investigate the role of gender and antecedents to innovation in private and publicly owned organisations separately, as employees in such organisations may differ from each other. Similarly, it may have been useful to assess these variables at managerial level versus subordinate level, or across operational versus support functions. None of these routes were followed, mainly because of concerns about sample size, given the requirements of the statistical analyses performed. Future researchers are, however, encouraged to consider including more homogeneous groups in their research, or samples large enough to compare groups effectively.

Furthermore, not amending the instruments which proved to be non-invariant across gender, as presented in the proposed model, but rather excluding them from the study, could be deemed as a limitation of this study. Strategies for making such adjustments, to meet measurement invariance requirements, are sparse (see Van de Vijver, Van Hemert, & Poortinga, 2015), and also threaten the theoretical integrity of the instruments. For example, "What would the effect be if two items were removed from a nine item instrument, measuring three constructs?" Following such a route *may* have created gender invariance, but certainly at a cost to construct validity. Future researchers are encouraged to explore this avenue, provided that they have the resources to verify the validity of the instruments after making such adjustments. Logic suggests that such adjustments should only be considered in cases where a specific construct is represented by many items.

7.5 Recommendations

Recommendations will be made with reference to the research, as well as to the business community at large.

Researchers and the business community, specifically consultants in the industrial and organisational psychology domain, who acquaint themselves with this thesis and the articles included in it, should now be better equipped to understand the concept of measurement invariance. They also have examples of how to operationalise measurement invariance, and have empirical evidence on the measurement invariance (across gender) for some instruments often used in the industrial and organisational psychology domain. Reading Article 4 (Chapter 5) could be a good introduction to the topic and is therefore recommended.

Understanding the concept of measurement invariance is important, as not testing for it, or not having clarity on it, could result in generating unfounded conclusions as the constructs may be differently perceived across groups. It is therefore recommended that researchers test for measurement invariance and report on this matter so as to enable industrial and organisational psychologists to make informed choices when selecting instruments. From a business perspective, leaders are urged to interrogate consultants on the instruments they use, and demand that evidence of measurement invariance be provided should the instruments be used across diverse groups, particularly if the intent is to make comparisons across groups. Reporting on measurement invariance or insisting on such statistics goes beyond the findings of this research, as the Employment Equity Act (Act 55 of 1998) prohibits the use of instruments that have not been scientifically tested to demonstrate that they can be applied fairly to all employees and are not biased to any specific group.

Given the empirical evidence presented in this thesis, researchers and practitioners have some guidance on which tests to use when measuring constructs across gender. At a designation level, the HRPS (Nyawose, 2009; Steyn, 2012), BCEAI (Hornsby et al., 2002; Strydom, 2013), MLQ (Avolio et al., 1995, 1999), and IWB (Kleysen & Street, 2001) proved to be measurement invariant across gender. The UWES-9 (Schaufeli & Bakker, 2003; Schaufeli et al., 2006), OCS (Allen & Meyer, 1990), and IPA (Bateman & Crant, 1993) proved to be non-invariant. It is thus recommended that the first group of instruments be used with confidence in the South African environment. Caution should be applied when using the non-invariant instruments, and more research in this regard is suggested. At a more theoretical or conceptual level, researchers and practitioners should be alerted to the tentative findings that instruments which related to the impersonal or public domains (i.e. HRPS, BCEAI, and MLQ, and to a lesser extent IWB) ended up being measurement invariant, whereas personal and

inward-looking measures (UWES-9, OCS, & IPA) proved to be non-invariant. Research regarding this differentiation concerning the nature of measurement invariant instruments is recommended. Furthermore, users of instruments which are inward-looking are alerted to the (stronger) possibility of measurement invariance in these instruments.

Specific to the antecedents of innovation in organisations, it can be reported that, irrespective of gender, human resource practices, then innovative climate, and lastly leadership styles, all significantly influence innovative work behaviour. It would therefore be wise to recommend improving human resource practices, before altering any of the other antecedents, when the aim is to achieve the maximum impact on innovative work behaviour. Practitioners are advised to stick to the basics, namely solid human resource practices, rather than developing specific innovation interventions to create a climate for innovation. This applies to both male and female employees.

Men, more so than women, display innovative work behaviour, as per self-reporting. Men also consistently react more positively with regard to innovation when exposed to the same organisational variables. These findings were produced when using measurement invariant instruments, in other words non-biased instruments, and therefore have important implications for theorists, practitioners and researchers. Some theorists, and particularly those in the feminist movement, should re-examine their gendered conceptualisations of innovation and align their ideas to the empirical evidence suggesting the masculinity of innovation (Garcia Martinez, Zouaghi, & Sanchez, 2016; Reutzel, Collins, & Belsito, 2018). Practitioners aiming to innovate and who choose to rely solely on empirical evidence, might want to recruit male candidates, in order to meet their innovation objective. However, it is recommended that practitioners use multiple sources to obtain data from employees before making any appointments. To researchers, the call is to go beyond data generated through self-reporting in their research, and use multiple sources to gain data on innovation in the workplace, as well as on the antecedents thereto.

The final recommendations relate to the design of research projects such as this one. It is recommended that only instruments with proven psychometric qualities, including evidence of measurement invariance, be used to assess the variables/constructs in proposed models. Alternatively, it is recommended that pilot studies be run, and analyses be performed on a multitude of psychometric properties, so as to avoid the inclusion of non-invariant

instruments in the full study. This should reduce the odds of removing variables from the proposed models as a result of inadequate psychometric properties.

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This reference list contains all the sources consulted while constructing Chapter 1 (the orientation) and Chapter 7 (the summary and conclusion).

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